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TREATISE

ON THE

PRACTICE OF MEDICINE

BY

GEORGE B. WOOD, M.D.,

PROFESSOR OF THE THEORY AND PRACTICE OF MEDICINE IN THE UNIVERSITY OF PENNSYLVANIA;
PRESIDENT OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA;
ONE OF THE PHYSICIANS OF THE PENNSYLVANIA HOSPITAL;
ONE OF THE AUTHORS OF THE DISPENSATORY OF THE UNITED STATES OF AMERICA;
ETC. ETC.

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TO

N. CHAPMAN, M. D.,

AS

A MARK OF RESPECT

FOR

HIS ATTAINMENTS AND SKILL IN MEDICINE;

FOR

HIS POSITION, FROM AGE AND SERVICE,

AT

THE HEAD OF THE MEDICAL PROFESSION IN THE UNITED STATES;

AND FOR

HIS MANY EXCELLENT QUALITIES OF HEAD AND OF HEART,

THIS WORK

IS AFFECTIONATELY INSCRIBED

BY

HIS FRIEND AND COLLEAGUE,

THE AUTHOR.

PHILADELPHIA, *January* 1847.

PREFACE

TO THE

FIRST EDITION.

In adding another to the many existing Treatises on the Practice of Medicine, the author may be reasonably expected to show upon what grounds he has ventured to advance a new claim to the public attention, already so fully occupied. He has no other excuse to offer than this; that he has written in obedience to impulses which he could not well resist. Having been engaged, for nearly thirty years, in public and private practice, and, during that time, devoted an almost exclusive attention to the study of diseases and their remedies, he has accumulated facts, and formed opinions, which have been long soliciting expression, with an urgency to which he has at length yielded, though unfeignedly distrustful of their sufficient value.

It will be inferred, from what has been said, that the present work claims to be something more than a mere compilation. In giving it the form of a General Treatise on the Practice of Medicine, it was incumbent upon the author, in order to do justice to his readers, to gather from every attainable source the knowledge which he might deem important; and he has accordingly consulted numerous works upon the different branches of his subject, and made ample use of the materials which they afforded. But these materials have for the most part been maturely considered, have been submitted to the closest scrutiny of which he was capable, and have been re-arranged in accordance with his own best judgment. In relation to facts, which, from having been known for a certain length of time, have become the common property of the profession, he has not deemed it necessary to quote authorities; but, wherever the influence of a name was thought necessary to support a position, or justice to individuals required that they should be noticed in connexion with their discoveries or opinions, he has considered it his duty to make the requisite references in the text.

As to those portions of the work which have been drawn from his own stores, the author does not wish to urge any strong claims to exclusive originality. The sources of our knowledge are so various, we learn so much from books, and hear so much from others, in addition to all that may be derived from our own observation, or result from our own reflection, that it would be extremely difficult for one who has lived long, and sought knowledge wherever it was to be found, to analyze what he may possess, and determine how much, if any, originated entirely with himself.

It would be impossible to enumerate, in this place, all the sources to which the author is indebted for the materials of the work. Many of them are mentioned in connexion with the subjects, in relation to which they were particularly consulted. He wishes, however, to acknowledge a peculiar obligation to the several contributors to those excellent works, the "*Dictionnaire de Médecine*," the publication of which has been but recently completed in Paris, and "The System of Practical Medicine," arranged and edited by Dr. Alexander Tweedie. It will be seen, from the frequent references in the following pages, that he has also derived great aid from the "American Journal of Medical Sciences," edited by Dr. Isaac Hays, which comprises a body of the progressive medical knowledge of the last twenty years, especially of that contributed by the physicians of this country, which it would be difficult to find elsewhere. Nor would the author be doing justice to his feelings, without acknowledging his indebtedness, for much of his practical information, to two individuals; the late Dr. Joseph Parrish, his private preceptor, whose intimacy it was long his happiness to enjoy, and whose peculiar views and modes of practice were as familiar to him as if they were his own; and Dr. N. Chapman, Professor of the Theory and Practice of Medicine in the University of Pennsylvania, under whose public instruction it was his good fortune to sit thirty years ago, and from whom were undoubtedly imbibed many of the facts and opinions which will be found detailed in the following treatise.

In relation to the mode in which the work has been executed, the author has little to say. The reader will draw his own inferences, as to its merits, not from what he may find in the preface, but from the book itself. The author claims no indulgence on the score of haste. His leisure has been for several years devoted to the preparation of the work, and there was no urgent necessity for its publication, which could justify him in giving it prematurely to the world. It may possibly be thought by some that diseases of little importance have, in many instances, received an undue share of attention; but the author has proceeded upon the ground, that every disease, which is at all worthy of notice, should be well understood. Nothing more than is necessary to this object should be said of the most important disease; and nothing less of that which is least important. It may not be amiss to state, in addition, that, in using the first person singular, when speaking upon his own authority, the writer has been actuated by no spirit of egotism, but merely by a wish to express the fact, without affectation, in the shortest and simplest mode.

The author is sensible of many imperfections in the work. He will undoubtedly discover others, when time shall have in some measure obviated the inevitable partiality of recent authorship. It will be his duty and his pleasure, should the work have the good fortune to reach a second edition, to correct, as far as may lie in his power, these defects, and all others, which a just and candid criticism, hereby cordially invited, may point out.

PHILADELPHIA, *January* 1847.

PREFACE

TO THE

FOURTH EDITION.

FROM the original preface it may be gathered that the design of the author, in preparing this work, was to present, along with the results of his own personal observation, experience, and reflection, in reference to the Practice of Medicine, such a view of this important department of medical science, as fairly to represent its general condition at the time. He wished, and spared no pains, to make the Treatise a safe and useful guide to the student and young practitioner; and was not without the hope, that the old and experienced might find something in it to aid them in the clearer understanding and treatment of disease. From the speedy exhaustion of three successive editions, all of them large, he feels justified in concluding that the work has, in some degree, met the wants of the profession; and the favour with which it has been received has served as a strong stimulus to him, in the several revisions it has undergone, to make it still more worthy of approval by increasing its practical usefulness. Since its first publication in 1847, there has been great activity almost everywhere of the medical mind; and a flood of new facts, observations, and speculations has been poured forth in the journals, in monographs, and in treatises more or less general, from which the author has faithfully endeavoured to gather whatever appeared to him true, and likely to be useful. In every revision, numerous alterations and additions have been made; and if, at present, the work is not better calculated than at any former time to fulfil the purposes for which it was written, the fault must be ascribed to the want of ability, and not to that of earnest endeavour, on the part of the author. One object with him has always been to increase its bulk as little as possible consistently with its more important qualities. This object he has sought to accomplish by studying brevity of expression; and it is surprising how much may be gained by sacrificing words, useless if not weakening to the sense, which, nevertheless, constantly present themselves to the writer, and are apt to escape a careless attention. As the reader will readily perceive, the same end has been promoted by consulting economy of space; so that few original works, it is presumed, will be found, which, with the same size of type, contain more printed matter within given limits than this. The author, therefore, ventures to hope that any increase in the value of the Treatise will be estimated, rather by the improved quality and greater amount of its matter, than by the number of its pages; though it has been found necessary also to swell the volumes considerably. With these prefatory remarks, he offers the work for the fourth time to the medical public, quite confident, from previous experience, that the profession will be disposed to judge favourably of his efforts, and to give them all the countenance they may be found to merit.

PHILADELPHIA, *January*, 1855.

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PRACTICE OF MEDICINE.

PART I.

GENERAL PATHOLOGY AND THERAPEUTICS.

Prefatory Remarks.

A Treatise on the Practice of Medicine, as the term is now generally understood, embraces all those branches of medical science, with the exception of Midwifery and Surgery, which have a direct reference to the knowledge and treatment of disease, and to the preservation of health.

That department of the Practice which has for its object the *knowledge* of disease is called PATHOLOGY, and is divided into *general pathology* and *special pathology*, the former treating of what is common to diseases in general, or to a number of them, the latter of what is peculiar to individual diseases. The second great department of the Practice, or that which concerns the *treatment* of diseases, is called THERAPEUTICS, which is also *general* or *special*, according as it teaches the principles of treatment common to many complaints, or the particular course demanded by each one separately. The third department, which embraces the *means of preventing* disease, or in other words of preserving health, has received the name of HYGIENE.

But, notwithstanding this scientific arrangement of the different subjects of practical medicine, it has been found that the natural mode of teaching it is the most effective. A stronger impression is made on the mind of the student, and one more available for practical purposes, by presenting him with a vivid picture of each disease in all its bearings, as it must hereafter offer itself to his attention, than by distributing its dissected parts among the various sciences to which they respectively belong, and thus separating what he will afterwards be compelled to put together again in practice. The former plan, therefore, will be followed in the present work. But there are numerous points in relation both to pathology and therapeutics, which are common to many diseases, and which may with great propriety be treated of in general, so as at once to render the subsequent study of particular diseases more easy, and to spare the necessity for much and wearisome repetition. Before proceeding, therefore, to an account of individual diseases, I propose to present, in the first part of the work, such principles and facts of universal or extensive applicability, as appear to me to be well established, avoiding speculation as much as possible, and seldom stopping to discuss the numerous hypotheses which have risen and disappeared, in rapid succession, in this as in other departments of medicine.

Definition of Disease.—Disease may be defined to be a derangement of the organization, or of one or more of the functions of the body. But this definition is defective, like almost all others referring to natural processes, which so run into one another, that a precise line of distinction can seldom be drawn between them. In the performance of every function, and in the condition of every organ, there is considerable diversity within the limits of health; and a state of things which, if continued, would constitute disease, may be so fugitive as not to merit the name; so that, both in point of degree and of duration, it is often impossible to say, of any particular variation from the ordinary condition of the system, whether it is healthy or morbid. For practical purposes, however, perfect accuracy of distinction is unnecessary. Derangements have usually passed considerably beyond the boundary which separates health and disease, before they are brought to the notice of the physician.

Division of the Subject.—In this part of the work I shall treat, *first*, of the CONSTITUENT FORMS of disease, or of those derangements which, by their various combination, constitute diseases as we ordinarily see them; *secondly*, of the causes of disease considered generally, forming the subordinate branch of pathological science denominated ETIOLOGY; *thirdly*, of the exploration of disease, in other words, the modes in which diseases may be recognized, one distinguished from another, and the whole course of each traced to its probable termination—a branch of general pathology which may be designated as SYMPTOMATOLOGY; and *fourthly*, of the general principles of treatment, or GENERAL THERAPEUTICS. Whatever observations may be necessary on the subject of HYGIENE will be most conveniently made in connexion with individual diseases.

CHAPTER I.

CONSTITUENT FORMS OF DISEASE.

Prefatory Remarks.

DISEASES, viewed superficially, appear to be exceedingly numerous and diversified; but, when subjected to analysis, they are found to consist of a comparatively few constituent states of derangement, by the combination of which, in various modes, in relation to number, seat, and degree, that great apparent diversity is produced. These constituent morbid states bear to diseases, in their ordinary forms, the same relation that the proximate principles of organic bodies bear to these bodies as found in nature; the same, for example, that sugar, starch, gum, &c., do to the bark or root containing them. That they are themselves necessarily simple or elementary, is not maintained. Efforts have been made to reach the elements of disease; but not very successfully; because we have not yet learned the essential nature of the healthy actions, and cannot, therefore, understand their derangements. But, though we cannot push analysis satisfactorily to the absolute elements, we are able to appreciate to a great extent their less complex combinations, forming the proximate ingredients of those associations of morbid states or actions usually called diseases. It may be admitted, as a self-evident proposition, that disease has its seat in the fluids or solids of the body, or in both.

SECTION I.

DISEASE OF THE FLUIDS.

In relation to the fluids of the body, our pathological knowledge, though greatly advanced within a few years, is still very deficient. There can be no doubt that all of them are occasionally unhealthy in their condition; and there can be as little doubt that, in this unhealthy condition, many of them may become the sources of serious disease. But the question is, whether the vitiated state of the fluids is original with them, or whether it arises from some disorder of the solids by which they are generated. During the prevalence of the Humoral Pathology, it was customary to ascribe most complaints to a morbid state of the liquids of the body; and, when this system was overthrown, medical sentiment turned with equal exclusiveness towards the solids. But at present an intermediate opinion prevails; and the truth probably is, that, while the greater number of diseases have their origin in derangements either of the functions or structure of the organs, others consist essentially in a disordered state of the liquids, though even these usually find expression in complaints of the fixed structures.

As all the fluids, with the exception of the lymph and chyle, are derived from the blood, and as the two former enter directly into the constitution of the latter, and convey into it all the deleterious principles which they may contain, the blood may be considered as the only fluid subject to original morbid changes, or at least the only one to which we are to look as the primary seat of diseases requiring our attention. The numerous liquid secretions, if deranged at the time of their formation, must be so in consequence of the diseased condition of the blood from which they are derived, or of the organs by which they are elaborated; if they become deranged after their formation, as sometimes happens with the bile, urine, and some others, it must be owing to their undue detention, or an undue influence of surrounding parts upon them, in either of which cases the solids are in fault.

1. There can be no doubt that the blood is very frequently the source of diseases, by serving as a vehicle through which noxious substances are enabled to reach the parts upon which they act. Many poisons prove fatal by entering the circulation through the medium of absorption; and the miasmatic and contagious effluvia probably operate on the system through the same channel. The body itself affords sources of a similar deleterious impregnation. Thus, the fetid contents of the bowels, if long retained, are often partially taken up by the veins or absorbents; and, in cases of mortification, the putrid results of that process may follow the same course into the circulation. Various morbid products, the results of deranged secretion, such as pus and the sanies of unhealthy ulcers, occasionally find an entrance into the blood-vessels; and it is believed by many that bile and urine, at least some of their characteristic principles, are absorbed in cases of unhealthy retention of these fluids. In all these instances, there can be no doubt that the noxious matters prove injurious to health by coming into contact everywhere with the tissues, and deranging their condition or function. How far they may act also directly on the blood, is a point for subsequent consideration.

2. Another source of vitiation in the blood is the accumulation of certain principles, which, normally existing in that fluid in very small proportion, are usually thrown off by the excretory functions, and, when retained, are capable of exercising a highly injurious influence. This accumulation may

result from a more rapid production of the principles in question, or from a diminished or suspended action of the organs by which they are naturally eliminated. Thus, uric acid is generated in the animal economy in a healthy state, but is thrown off by the kidneys so as not to be readily discovered in the blood. In persons who live chiefly on animal food, and take little exercise, the quantity of this acid is sometimes very much increased, so that it is not only secreted in unusual abundance by the kidneys, constituting gravel, but is also deposited in other parts of the body, especially in the joints and fibrous tissues. It is not improbable that its accumulation in the blood, under these circumstances, may be the cause of some of those peculiarities which distinguish gouty affections. Again, when the secretion of urine is arrested, the urea, which commonly escapes with this excretion, remains in the blood, and imparts to it highly noxious properties. The same remark may be made of the colouring principle of the bile, which, upon a cessation of the hepatic secretion, becomes redundant in the blood, and, being thrown off by the skin and kidneys, produces jaundice. Bernard has proved that glucose or grape sugar is generated as a normal product in the liver, and thence carried to the lungs where it is consumed. If too largely generated in the former organ, or insufficiently consumed in the latter, it enters the general circulation, and, being thrown off by the kidneys, gives rise to diabetic urine. There is reason to believe that other principles, elaborated by the digestive and absorbent processes, or resulting from the partial disintegration which the blood itself, as well as all other constituents of the body, are perpetually undergoing in their normal operations, exist in the circulation, and prove innocent in health only because they are rapidly eliminated with the urinary, cutaneous, pulmonary, or intestinal secretion. Hence, probably, one of the sources of the numerous evils which result from the suppression of these secretions. In certain febrile conditions, the sour breath and sour perspiration evince the existence of an acid in the blood, which probably aids other causes in sustaining the disease, and the elimination of which may be one of the advantages of diaphoretic medicines in these complaints.

3. Hitherto, we have considered the blood as vitiated in consequence either of some foreign principle being admitted into it, or of the accumulation of some principle which, though naturally entering the circulation, is, in the healthy state, thrown out as fast as it enters. But it must also be regarded as in a morbid state, when any one of its ordinary and essential constituents becomes either greatly redundant or greatly deficient. Such a redundance or deficiency may result from the peculiar character of the food out of which the blood is elaborated, or from some modification in the functions concerned in its elaboration, including those which supply it with materials, as digestion and absorption, those which abstract materials from it, as secretion and nutrition, and those which contribute to both these ends, as circulation, respiration, and probably nervous action. Healthy blood contains in 1000 parts from 110 to 140 parts of the red corpuscles, from 2·5 to 3·5 parts of fibrin, and from 65 to 70 parts of pure albumen. Any considerable excess or deficiency of either or all of these ingredients, in reference to the numbers mentioned respectively, must be regarded as morbid.*

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* It may be useful to present to the student a slight sketch of the constitution of the blood, as now generally admitted. This most important constituent of the system consists of a liquid denominated *liquor sanguinis*, in which float certain minute organized bodies, denominated *corpuscles*, which only the microscope can render distinctly visible. The liquor sanguinis consists of *water*, holding in solution or intimate admixture *fibrin*, *albumen*, *extractive* and *fatty matters*, and *various salts*. The corpuscles are of two kinds, one denominated *red corpuscles*, to which the blood owes its colour,

Sometimes, under the influence of a rich diet and vigorous digestion, with a comparative deficiency in the nutritive process, the solid organic principles

and the other, in comparatively very small proportion, called *white* or *colourless corpuscles*. Besides these ingredients, there is held in solution more or less gaseous matter, which is chiefly *oxygen* and *carbonic acid*, the former existing in the arterial, the latter in the venous blood; and a volatile principle which, when the blood is drawn, is exhaled with a peculiar and characteristic odour. These may be considered as proper constituents. But the blood also contains minute quantities of urea, bilious colouring matter, and probably various other substances, the results of its own disintegration, or that of the solid tissues, which are present in it merely in order that they may escape from the system, and in fact, in the healthy state, are eliminated as fast as they originate in or enter it.

MM. Guillot and Leblanc believe that they have detected *casein* as a normal constituent of the blood. The proportion has not been ascertained; but it appears to be inconstant, though the principle is always present in health. It is peculiarly abundant in the female during lactation. (*Archives Générales, 4e sér.* xxiv. 364.)

When removed from the body the blood undergoes a new arrangement of its constituents. The fibrin, before held in solution, now spontaneously coagulates, involving the corpuscles, and forming the clot, which at first holds the liquid part mechanically entangled in its meshes, but gradually separates from it by a firmer contraction. The liquid thus deprived of the fibrin is called the *serum*, and contains the albumen, salts, and extractive and fatty matters of the liquor sanguinis.

The red corpuscles, which are cells containing a red liquid, are not chemically homogeneous, but consist of various substances, most of which are identical or analogous with the constituents of the liquor sanguinis, but one at least, denominated *hematosin*, is quite distinct, being the principle to which the red corpuscles and consequently the blood owe their colour, and having this striking peculiarity, that it contains a definite proportion of iron as one of its elements. M. Le Canu gives the following as the result of his latest researches into the chemical composition of the red corpuscles: 1. *hematosin* or *red colouring principle;* 2. *albumen*, and *extractive, fatty*, and *saline matters*, differing in nothing from those of the serum; 3. *globulin*, an albuminous substance, but distinguishable from ordinary albumen by its solubility in hot diluted alcohol, and by forming with cold water a solution, which is not troubled by the subacetate of lead; and 4. a *fibrinous substance* constituting the envelope or cell-wall of the red corpuscles, and differing from ordinary fibrin in being insoluble, even at a boiling temperature, in a solution of potassa containing one-tenth of the alkali. (*Journ. de Pharm. et de Chim. 3e sér.* xxii. 339.)

Of the chemical nature of the white corpuscles little is definitively known. They are believed to be identical with the lymph corpuscles, and to enter the circulation with the fluid of the thoracic duct. It has been rendered highly probable that they constitute a stage in the development of the red corpuscles. No method has yet been discovered of ascertaining their exact relative amount in the blood, but, compared with the red corpuscles, they are in very small proportion in health.

For a more particular account of the properties of the constituents of the blood above mentioned, the reader is referred to the recent anatomical and physiological works. It will be sufficient here to call his attention to some of the latest observations, which may not yet have found their way into systematic treatises.

From the researches of Doctors Leconte and de Goumoens it appears that albumen, fibrin, and globulin, as well as other albuminoid substances, are always composed of two distinct chemical constituents, one soluble and the other insoluble in crystallizable acetic acid. In fibrin, the first of these constituents has when isolated the form of granules, the second retains that of fibres. As obtained from albumen or globulin, they cannot be distinguished by the microscope, but still have precisely the same chemical characters as those of fibrin. These are interesting facts, having a strong bearing on the physiological properties of albuminoid substances, and tending to show a higher grade of fibrin than of the others, in reference to organization. (*Archives Générales*, Juin 1853, p. 681.)

The fact is stated by M. Verdeil, that hematosin has strong analogies with chlorophylle, or the green colouring matter of plants, when freed from a fatty impurity associated with it as ordinarily obtained. (*Chem. Gaz.* Feb. 16, 1852, p. 74; from *Comptes Rendus*, Dec. 1851.) In reference to hematosin, another interesting statement, which at present must be looked on rather as a probable conjecture than as a fact, is that the colouring principles of the urine and the bile, are merely altered conditions of that of the blood increase so much as to constitute a state of disease. The blood is intensely red, and, when taken from the body, affords a larger and firmer coagulum than in health. It is in this state highly stimulating to the organs, and may give rise to a general excitement amounting to fever, or to local inflammation or hemorrhage.

Again, owing to a meager diet, feeble digestion and sanguification, and various exhausting agencies, separate or combined, a condition of the blood often occurs in which the solid constituents are deficient, and the proportion of liquid excessive. Profuse hemorrhage, or frequent and large bleedings, produce the same effect by diminishing the volume of the circulating mass beyond the remunerating power of the digestive process, so that the deficiency must be supplied by the absorption of watery fluid. I have had under my care a case, in which bleeding had been so profusely employed that the vessels became filled with a turbid serum, which appeared, as it fell into the basin, like reddish dirty water, and, upon being allowed to stand, afforded a coagulum which bore an exceedingly small ratio to the liquid portion. This condition of the blood constitutes a variety of the disease called *anæmia*, which will be fully described hereafter.

principle, resulting from the normal disintegration of the red corpuscles after the period of their active life is past.

As useful to the reader for reference in the perusal of this work, the following tables of the composition of the blood are given, offering the average of the results obtained by numerous experimentalists. They are taken from the last edition of Kirkes and Paget's *Manual of Physiology.*

1. Chief constituents in 1000 parts of the blood.

Water	784.00	Fibrin	2.20
Red corpuscles	131.00	Extractive and fatty matters, &c.	6.77
Albumen of the liquor sanguinis	70.00	Saline matters	6.03

2. All the constituents in 1000 parts.

Water		784.00	Inorganic Salts.	Chloride of sodium	3.60
Albumen		70.00		Chloride of potassium	0.36
Fibrin		2.20		Tribasic phosphate of soda	0.20
Red Corpuscles.	Globulin	123.50		Carbonate of soda	0.84
	Hematin	7.50		Sulphate of soda	0.28
Fatty Matters.	Cholesterin	0.08		Phosphate of lime and magnesia	0.25
	Cerebrin	0.40		Oxide and phosphate of iron	0.50
	Serolin	0.02	Extractive matter, with salivary matter, urea, biliary colouring matter, gases, and accidental substances		5.47
	Oleic and margaric acids, volatile and odorous fatty acid Fat containing phosphorus	0.80			

The fibrin must be considered as including the white corpuscles, which chemists have yet been unable to examine separately. The proportion of fibrin given in the above table is below the average generally admitted, which is about 3 in 1000 parts.

It should be stated that arterial blood differs in the proportion of its constituents from venous; containing, according to Dr. J. Béclard, more of the red corpuscles and somewhat less of the fibrin. From the experiments of the same physiologist it would appear that, while the arterial blood is identical in all parts of the system, the venous differs in different situations. Thus, the blood returning from the spleen contains less of the red corpuscles and more of the albumen and fibrin than the venous blood of the general system; while that of the mesenteric veins varies according to the period of digestion, having a considerable increase of albumen with diminution of the red corpuscles in the early stage of digestive absorption, and precisely the reverse condition after the absorption has been completed. (*Archives Générales, 4e sér.* xviii. 412.) It has been stated in the text that, according to the observations of Bernard, glucose or grape sugar is found as a normal constituent in the blood of the liver, and in the route of the circulation thence to the lungs, but in no other part.

But not only is the blood liable to a general excess or deficiency of its organic constituents; there are also great diversities in the proportion which these constituents severally bear to each other; and excess or deficiency in any one of them may become a source of disease. Thus, an excess of the red corpuscles often occurs without any increase of the albumen or fibrin. This is indicated by a high degree of colour in the blood, a greater or less coloration of the serum, a large but not unusually firm coagulum, and the uniform absence of the buffy coat. It constitutes an active plethoric condition, and predisposes to fever and hemorrhage. If, in connexion with this excess of the red corpuscles, there be a deficiency of fibrin, the clot may still be large, but it will be unusually soft, and, along with the tendency to fever and hemorrhage, will be a feeble state of the vital actions. Not unfrequently the red corpuscles, instead of being in excess, become deficient; the other principles being either unaffected, positively increased, or diminished in less proportion. In this state, the blood is less highly coloured, the coagulum small in proportion to the serum, and the surface of it often covered with a buffy coat; and the system exhibits the morbid phenomena of anæmia. This condition is induced by low living, the loss of blood, and various exhausting diseases; and it is a singular fact, that the red corpuscles suffer from these causes much more and sooner than the fibrin and albumen, though these latter principles are also at length diminished by depletion.

An excess of the fibrin is equally common in disease. The signs of it are firmness and tenacity of the coagulum, and very often the appearance of the buffy coat on its surface. Though the fibrin is the coagulable part of the blood, yet its relative proportion must not always be judged of by the mere size or density of the clot. The degree of its firmness or tenacity is a better test. If the coagulum is at once large and very firm, the fibrin must be abundant; if voluminous and heavy, but soft, it may be deficient; the bulk of the clot being produced by an excess of the red corpuscles. The fibrin, too, appears to possess different degrees of contractile power; and, without reference to the red corpuscles, the quantity of it may be considerable in a small coagulum, and deficient in a large one; the clot being in the former case firm, tenacious, and capable of yielding little serum on pressure, in the latter, loose in its texture, and full of diffused serum. Excess of fibrin is one of the characteristics of the inflammatory state, being, however, a result of that state, rather than a cause of it. Yet it is highly probable that such an excess may predispose to inflammation, especially when associated with a superabundance of the other animalized constituents.

Deficiency of fibrin results from insufficient food, from excessive fatigue by which it is consumed, and from various influences the mode of action of which is unknown, as in the low forms of fever. It is shown by a feeble coagulating power in the blood or the total want of it, by the smallness and softness of the coagulum when formed, and by the absence of the buffy coat. It probably predisposes to hemorrhages, and diseases of a low character; and interferes greatly with the reparative powers of the system.

Albumen may also be excessive or deficient. A great excess of it may be known by the viscidity which it imparts to the serum, and which is sensible to the touch. Its quantity may be more precisely measured by the increased specific gravity of the serum, which in health is about 1·03, and by the amount of the coagulum which the serum yields when heated. The circumstances which contribute especially to its excess do not appear to have been well ascertained. That a superabundance of it is often connected with the inflammatory condition, either as cause or effect, would appear to be established by the experiments of Dr. Traill and M. Gendrin, who found nearly twice as much albumen in the serum of the blood in that condition as in health. (*Andral's Precis*, &c., i., 534.) It must be confessed, however, that different results have been obtained by other experimenters. MM. Becquerel and Rodier found a diminished proportion of albumen in a number of cases of well-marked inflammation. (*Simon's Chemistry*, i., 252.) It has been stated that the fibrin of the blood increases during inflammation. It is very probable that this increase takes place at the expense of the albumen. If this be the case, we can readily understand the different results obtained by experimenters. The albumen may be excessive in the blood before and at the commencement of the inflammation, but may become deficient before the end of it, in consequence of conversion into fibrin. It is highly probable that an excess of albumen predisposes to inflammations, if it do not actually produce them; and its predominance is supposed by some writers to favour the development of that form of inflammation usually denominated scrofulous. A deficiency of albumen may take place in consequence of an impoverished diet, great loss of blood, or morbid albuminous secretion, as in Bright's disease of the kidneys. It is important, as being supposed to constitute a predisposition to dropsy.

A morbid state of the blood has recently attracted attention, in which the white or colourless corpuscles are in great excess. The name of *leucocythemia* has been proposed for it by Professor Bennet of Edinburgh, by whom a detailed account of it was first presented to the profession. It is unnecessary to say more of it in this place, as it will be fully treated of among the special diseases of the blood.

The watery part of the blood, which, in consequence of a diminished supply of the solid ingredients, is occasionally in very great excess, may become as greatly deficient under the influence of rapid and abundant secretion, such, for example, as occurs in bad cases of malignant cholera. The blood then becomes thick, and flows with difficulty through the capillaries; the respiratory function, as well as the functions of nutrition and calorification, is imperfectly performed; the heart beats feebly; the nervous centres languish under the want of their accustomed stimulus; and the system either sinks irrecoverably into a state of universal prostration, or reacts slowly, and finds its way again to health through a long series of irregular sanguineous determinations, amounting often to inflammation. It is worthy of observation that, in the midst of the greatest prostration proceeding from this cause, the patient often has a thirst equal to that which attends the highest state of fever.

The salts of the blood escape with its watery portion; and much importance has been attached to this fact in a pathological point of view. Dr. Stevens has attempted to show that the presence of saline matter is essential to the change of venous into arterial blood; and the black colour of the blood in cholera has been ascribed to a deficiency of its salts. This colour, however, may be attributed also in part to a concentration of the colouring matter, dependent upon the loss of much of the fibrin and albumen of the blood along with its watery portion, while the red corpuscles remain; for hematosin is black when isolated and in mass. Saline matter impairs the coagulability of the fibrin in blood out of the body.

Fatty matter, which has been proved to exist in healthy blood, becomes occasionally so abundant as to impart a whey-like appearance to the serum, and in some rare instances to render it white and opaque as if mixed with milk. Dr. Christison obtained on one occasion as much as five per cent. of fat from milky serum. But the influence which this condition of the blood may exert in producing disease in the solids has not been ascertained.

It is well known that blood which does not undergo the change from venous to arterial in the lungs becomes unfit for the sustenance of life; but whether the result is owing to the accumulation of some carbonaceous principle which proves noxious when in excess, or to the want of that oxygenation which it is generally believed that the blood undergoes in the lungs, is a point which yet remains undecided.

4. Lastly, the blood may become diseased by changes in the character, as well as in the relative quantity of its constituents. Such changes may happen in various ways, independently of the entrance into the circulation of any foreign principle. There are not wanting facts to show that they may result from disordered nervous influence. If, under such influence, the products of secretion performed in the capillaries may become unhealthy, as is generally believed, there can be no difficulty in admitting that the blood itself in these capillaries may undergo alteration from a similar cause. If nervous action be, as some suppose, analogous to the galvanic, we can readily understand that it may be capable of modifying the condition of the vital fluid submitted to it in the extreme vessels, as water is decomposed when placed between the poles of a galvanic battery. We can conceive, also, that the constituents of the blood may be modified by the varying condition, within the body, of those subtle principles which exercise so powerful a chemical agency without it; viz., heat, light, and electricity. The effect of lightning in altering the condition of the blood is well known. In the capillary circulation, moreover, where the particles of the blood come into exceedingly close relation with those of the solids, where, probably through cell-action, molecules from the former enter into the latter, and others again separating themselves from the solids take their place in the circulating mass, there may be a play of vital affinities, capable, when perverted, of producing a complete revolution in the state whether of the blood or of the fixed tissues. Again, the kind of food out of which the blood is made by the assimilative processes, may affect the character of its constituents as well as their proportion; as is abundantly proved in the case of scurvy, which is generally produced by a long continued abstinence from fresh vegetable food, with other co-operating causes. Finally, as blood probably possesses in some degree a self-developing power, converting its unorganized ingredients, such as albumen, oil, &c., into living germ-containing matter, and elevating its lower into its higher forms, as the white probably into the red corpuscles, it follows that changes in its state of healthy power may lead to irregularities in its physical constitution, and consequently in the proportion and character of its several constituents.

But probably the most frequent cause of morbid alteration in the character of the blood is the influence of various deleterious agents which are absorbed into or otherwise enter the circulation either from without, or from sources within the body itself. That the blood is materially changed in this way no longer admits of a doubt. The injection of putrid substances into the veins is followed by a loss of coagulability in the blood, and a tendency to more speedy decomposition; and the same effects have resulted from the influence of certain poisons. It is highly probable that the various deleterious substances before referred to as finding an entrance into the circulation (see *page* 3), change the blood by a direct influence upon it, independently of any derangement they may produce in the blood-supplying functions. Foreign substances in the circulation may alter the blood in three different methods. In the first place they may produce the effect by chemical reaction with one or more of the constituents of that fluid. In the second place, they may by their mere presence set on foot chemical changes, or a series of changes in the blood, upon the principle of a ferment. Thirdly, they may act upon the vital properties or susceptibilities of the living and organized constituents of the blood, modifying their condition and powers, precisely as they derange the living solids through a similar influence.

Of the particular modifications which the blood undergoes from these and other causes, not much is known; and a wide field is here open for experimental research. That the red corpuscles are often changed is to be inferred from the greatly altered colour of the blood in certain diseases, as in bad cases of scurvy and in malignant fevers, in which it is sometimes almost black, and also from the fact that the corpuscles themselves are occasionally, in morbid states of the blood, found dissolved in the serum. The coagulability of the fibrin is sometimes so much augmented, that it becomes solidified in the vessels during life, and the resulting masses are asserted to have occasionally taken on an independent organization. On the other hand, the cohesive affinity of the particles of the fibrin is frequently much diminished, or entirely destroyed, so that the blood when taken from the body, or examined in the vessels after death, is found to coagulate but feebly, and sometimes to be incapable of coagulation altogether. We find this condition in some cases of purpura, not to speak of malignant fevers, and certain poisonous affections, in which the cause of this change in the blood is wholly or in part derived from without. It is highly probable that the fibrin undergoes, through the direct agency of deleterious substances absorbed, especially the sanies from unhealthy ulcers, abscesses, &c., another modification, appreciable only in its results, by which its vital force is impaired, and it is rendered incapable, when thrown out of the blood-vessels, of becoming duly organized, so that it is degraded into pus, or other morbid product. Cases are on record in which air has been evolved from the diseased blood in such quantities as to cause death. If it be admitted that the blood may thus become deranged through influences operating directly upon itself, the inference cannot be avoided that diseases may have their essential seat in that fluid, even though the symptoms may also indicate great derangement of the solids; for the blood is so essential both as an excitant and nutritive agent to all the functions and tissues, that they must all feel its deficiencies, and express that feeling in various morbid phenomena. Purpura and scurvy are now generally believed to have their seat primarily and essentially in the blood; and the present tendency of medical opinion is to include in the same category all febrile affections dependent on an absorbed poison, whether malarial or contagious, as typhus fever, yellow fever, small-pox, measles, scarlet fever, erysipelas, &c. But there is some danger that, in the reaction from the old exclusive solidism, we may go too far, and with our attention engrossed by the diseased state of the blood, may overlook the obvious fact, that the very agents which are thus changing the blood, have probably also an equal power to act deleteriously on all the tissues with which they may be brought into contact, and that the circulating fluid, instead of being the special seat of the disease, merely participates in the universal derangement.

The blood, and the solids through which it circulates, are so intimately related, their mutual reactions are so constant and essential, that any disorder in one can scarcely exist without some change in the other, and, in every case of extensive disease, it may be very confidently asserted that both are more or less involved. Numerous experiments have established, that blood taken from a diseased animal, and injected into the veins of another in health, often produces the most fatal consequences; though the same operation, performed with the blood of a healthy animal, is usually followed by no serious results; thus proving that the blood participates in the disease of the solids. It is probable that, in many cases, morbid impressions are simultaneously made upon both. In many others, it is impossible to decide in which of the two the disease has its original seat. There are often chains of morbid actions of which each link constitutes a disease. Thus, some part of the body may be affected with extensive mortification, the putrid results of which may be absorbed into and contaminate the blood, which may then operate upon the system at large, producing a state of things analogous to typhus fever. Here the distinct links are, *first*, the mortification, *secondly*, the diseased blood, and *thirdly*, the typhoid condition; and whether the fluids or the solids be considered as essentially the seat of the morbid action, depends upon the point in its progress to which the attention is directed. In the vast majority of cases, it is to the solids that attention is chiefly directed, because in them the alterations are more within the scope of observation, and from their nature are more susceptible of investigation. The structure of the solids, moreover, is vastly more diversified, and consequently their derangement involves a much greater variety of morbid action. Besides, the morbid states of the blood are yet little understood, and are perhaps incapable of being fully investigated in the present state of chemical knowledge. From all these causes it happens that, in a treatise on the practice of medicine, the condition of the blood is comparatively but seldom brought into view in its relation either to pathology or therapeutics. Still, no physician can do full justice to his patients, or contribute his due share to the advancement of medical science, who does not constantly bear in mind the important part played by that fluid, and its all pervading influence as well in disease as in health.

SECTION II.

DISEASE OF THE SOLIDS.

It is not to be concluded, from the title here given, that all the forms of disease treated of under this head are considered as having their seat exclusively in the solids. The object is only to convey the idea, that it is in this situation that they display their characteristic phenomena. They may be arranged in two divisions, one embracing those which proceed directly from purely mechanical or chemical causes, the other, those which result from some agency exerted upon the vital properties.

SUBSECTION I.

DISEASE FROM MECHANICAL OR CHEMICAL CAUSES.

It is only the immediate effects of such causes that belong to this division. The secondary effects are consequent upon a disturbance in the functions produced by the injury already received, and belong, therefore, properly to the second division. Thus, by means of external force, the flesh is lacerated, or a bone is broken, in the living exactly as in the dead body; and the resulting wound or fracture is a mere mechanical effect; but the inflammation and fever which follow the injury are exclusively vital phenomena, and obedient to vital laws. Most of the affections belonging to this section fall within the domain of surgery, and others are so connected with the vital derangements to which they give rise, that they cannot be separately considered with advantage. Little more, therefore, need here be done than to arrange them under heads corresponding with their causes, so that the student may have a general view of the whole in a regular order.

1. First in the series may be mentioned the effects of external violence; as contusions, wounds, fractures, and dislocations. These are purely mechanical, and belong to the province of the surgeon; though their consequences often come under the notice of the physician, and will be treated of elsewhere.

2. Analogous to the preceding are the results of certain chemical agents, so powerful as to produce immediate disorganization of the parts to which they are applied. They act either by so strong an affinity for one or more of the principles entering into the composition of the part as to overcome the resistance of its vitality, or by an influence which brings latent affinities existing between these principles into energetic action, and thereby produces new combinations entirely subversive of organization. Corrosive or caustic substances act in the former manner, intense heat, in the latter. If caustic substances, however, be applied in a certain state of dilution, or if heat be applied in a moderate degree, they will not then operate as chemical agents. Their affinities, or those which they call into play, are not sufficiently energetic to overcome the vital resistance. They operate merely as irritants or stimulants; and their effects must be ranked with those of other causes acting on the vital properties. Even a caustic effect, so far as this term refers merely to the death of any portion of the body, may result from such an influence, altogether independently of chemical laws. A part may be stimulated beyond its powers, and may thus lose its life in consequence of excessive excitement. Substances are capable of producing this effect which exhibit no action upon the dead body. Such results do not belong to this section, which embraces only the direct effects of a purely chemical influence, such as would also be experienced upon the application of the agent to the body after death.

3. Next in order are the effects of gravitation. Under the influence of this principle, all the liquids have a tendency to settle into the most dependent part. The vital forces which maintain the circulation, and keep up a degree of contraction in all the living tissues, are sufficient in health to counteract any degree of this influence to which the system is ordinarily exposed. But, when excessive, it is capable of producing local derangements even in a state of general health. Thus, in consequence of long standing, the blood accumulates in the feet and legs beyond the fatigued power of the circulation to remove it, and the result is a varicose distension of the veins. Thus also the liquid which is everywhere moderately secreted by the cellular tissue, but which is ordinarily absorbed as fast as secreted, has, under similar circumstances, a tendency to subside into the lower extremities, where it accumulates faster than the absorbents of those parts can remove it, and an edematous condition of the feet and legs results. Hence the varicose veins and swollen extremities to which soldiers on long and hurried marches, and other persons constantly on their feet, are liable.

These results are much more striking when the force of the circulation and the organic contractility are morbidly feeble. Swelling of the legs often takes place under such circumstances, even though the patient may not be more frequently than is usual in the erect posture; and the effect is of course greatly increased by an increase of the cause. Andral ascribes to this cause the mortification which sometimes occurs in the extremities of very old people. The forces which move the blood are too feeble to overcome the influence of gravitation; the blood, therefore, stagnates, and the death of the part follows.

4. The immediate consequences of a mechanical obstruction to the course of the circulating fluids are also among the diseases belonging to this section. When the venous trunks are the seat of the obstruction, congestion takes

place in the part from which the vessels emptying into these trunks proceed, effusion of blood, or of serous fluid results from the distended state of the capillaries, the functions of the part are impaired or wholly deranged, and, if the obstruction be complete or nearly so, mortification occurs as a necessary consequence of the want of those properties in the retained blood which are essential to the support of all the vital actions. If, on the contrary, the artery be obstructed, the part in which it ramifies languishes from the want of blood, and may perish from the same cause, if the caliber of the vessels be quite obliterated, and the blood be unable to find its way through the anastomosing branches. Obstruction of the absorbents gives rise to tumefaction, partly from the distended state of the vessels themselves behind the part affected, partly from the accumulation of effused fluid consequent upon deficient absorption. The obstructing cause is often such as to affect more than one of these sets of vessels, and the results are modified accordingly.

The causes of obstruction may be external, as ligatures around the limbs or neck, tight lacing, and pressure either by the weight of the body, or from some extraneous source; or they may be internal, as tumours, enlarged or indurated glands, aneurisms, the impregnated uterus, diseased contractions or thickening of the coats of the vessels, or the presence of coagulated blood or fibrin within their caliber.

Obstruction to the course of the blood, and consequent congestions, may arise also from a loss of due proportion between the cavities of the heart, and from contraction or insufficiency of the valves; but this subject will be fully considered under the head of diseases of the heart.

Any impediment to the capillary circulation in organs supplied by the ramification of large vessels conveying venous blood, must prove an obstruction to the circulation in these vessels, and consequently a cause of congestion in those parts of the body from which they proceed. Thus, if the capillaries of the liver, whether from constriction produced by irritation, from debility, or from any other cause, cease to convey the blood through this organ with the usual rapidity, the portal vein becomes necessarily distended, and congestion takes place in the stomach, bowels, and all those parts the veins of which empty into that great trunk. So also, in the case of a similar impediment suddenly produced in the capillary circulation of the lungs, as in the instance of death from asphyxia, the pulmonary arteries, the right cavities of the heart, and consequently the general venous system become congested, as is evinced by the bloated and livid countenance, the prominent eyes, and the whole surface injected with dark blood, giving the skin a mottled appearance.

5. Obstructions in the excretory ducts of glands, or other passages intended for the escape of secreted fluids, give rise to a series of morbid phenomena, which, in their first step at least, must be considered in the light of mechanical affections. The fluid of which the outlet is closed accumulates in the tubes or receptacles behind the point of obstruction, producing distension, which is in some instances enormous, and which, unless relieved, results in a rupture of the coats, and not unfrequently fatal effusion of the liquid into neighbouring parts. Another result is either a re-entrance into the circulation, by means of absorption, of the secreted fluid or some of its constituents, or the retention in the circulation of principles which would otherwise be thrown off by secretion; this process being arrested by the pressure of the accumulated fluid. As some of these principles are noxious when existing in excess in the blood, very serious effects are occasionally produced. Thus, when the duct which conveys the bile into the intestines is closed, this liquid necessarily accumulates behind the point of closure, and there is danger of rupture of the ducts or of the gall bladder, and of

fatal effusion into the abdominal cavity. The colouring matter and probably other principles of the bile may be absorbed; and, as the secretory action of the liver is restrained by the pressure of the fluid accumulated in the ducts, the bilious matter ceases to be eliminated as rapidly as usual, and consequently, from this cause also, becomes redundant in the blood. Here it acts as a poison, producing various morbid sensations, which are partially relieved by the escape of the offending cause by different emunctories, as by the skin and kidneys, giving rise to jaundice. A similar train of consequences follows an obstruction of the ureters.

The causes of such obstruction may be external to the tubes, as indurated tumours in neighbouring parts; or they may consist in an altered state of the coats of the tubes, as thickening or spasmodic contraction; or, finally, they may be within the cavity of the tubes, as calculous concretions, or viscid and impacted secretions.

6. Lastly, under the head of mechanical affections, may be enumerated some of the immediate consequences of obstruction in the respiratory passages and alimentary canal; as suffocation from a foreign body either in the larynx, or in the œsophagus pressing upon the trachea; inability to swallow from stricture of the œsophagus, from a foreign body in that tube, or from pressure made upon it by a tumour; and stoppage of the contents of the stomach and bowels from stricture, intussusceptio, strangulated hernia, or accumulated and hardened feces. But in these and similar cases, the mechanical results are so intermingled with vital derangements, or so immediately followed by them, and the latter are so much the more important, that the cases are most advantageously treated of in connexion with these derangements.

SUBSECTION II.

DISEASE FROM INFLUENCES UPON THE VITAL PROPERTIES.

All living parts are endowed with the property of excitability, or in other words are capable of being brought into and maintained in action by the influence of certain agents either internal or external. The excitation thus produced is essential to the preservation of life, and is susceptible of considerable variation in degree or extent, without exceeding or falling short of the limits of health.

But, under the influence of certain causes, this excitation may be increased or diminished so as to occasion uneasiness to the individual, and interfere with the due performance of the functions. Even under these circumstances, it can scarcely be considered in the light of disease, if the variation from the due standard be of very brief duration. Thus heat and cold, in the ordinary changes of the seasons, often produce painful impressions, the former with an augmented, the latter with a diminished action of the part affected; but, if these impressions disappear immediately on the removal of the cause, leaving no permanent derangement, they do not constitute disease. It is, indeed, impossible to say where precisely, in the advance or retrocession of excitation, health ends and disease commences.

The morbid excitation may be such as to affect only the function of the part or organ which is the seat of it, or it may be attended with a change of structure. Some pathologists have, indeed, denied the existence, in any case, of functional without organic change. But, certainly, it is not impossible that a part may act in one way or another; that the heart, for example, may beat more or less frequently; that more or less liquid may separate from the blood; that a more or less rapid nutrition may take place, without alteration of structure. Whether, therefore, in all such cases, there is or is not organic change, must rest upon observation; and we every day witness instances of disease in which no such change is discoverable; as in the various neuralgic affections. As we cannot draw the line precisely between health and disease, neither can we determine always where functional disorder ends and organic begins. The latter is usually preceded by the former; and, as a general rule, functional disorder long continued, ends in structural lesion.*

But all disorder is by no means the consequence of augmented action. A depression of action below the standard of health is equally a morbid state. This may arise directly from the application of sedative agents, or the withdrawal of the ordinary healthy excitants, or indirectly in consequence of certain physiological laws, to be explained in another place. It may be only functional, or may be attended with organic change, and result even in the death of the part affected.

In the case both of morbid exaltation and morbid reduction of the vital actions, the excitation and depression may be in the line of health, though above or below it; or they may deviate from this line, and present peculiar characters independent altogether of mere difference in degree. This has been denied by certain pathologists, who maintain that all disease is a mere augmentation or diminution of the actions of health, and that one disease differs from another only in degree or locality. But the instances are so numerous in which affections, occupying the same structure, present characters entirely different, independently, to all appearance, of the grade of action, or even of peculiarities in the organization of the part affected, that the position above stated must be held true, unless the phenomena can be demonstrated to be other than they seem. To adduce only a single example; a gland in the groin may become the seat of different diseases; one of which shall result in the production of healthy pus, followed by speedy restoration to health, as common inflammation; a second, in the generation of a peculiar virus, capable of producing the same disease in another, as syphilis; a third, in the deposition of a cheesy matter, with slow suppuration and very lingering recovery, as scrofula; a fourth, in characteristic degeneration of structure, utterly different from anything seen in health, or in other forms of disease, as cancer. No satisfactory explanation has yet been given of these and numerous other diversities, upon the principle of the unity of morbid action; and the beauty or simplicity of a theory is not a sufficient reason for admitting its validity, in opposition to the evidences of the senses.

There are, moreover, diseased conditions, which are not in themselves necessarily connected with an elevation or depression of the vital actions, but exhibit a complete change or perversion of them, and the substitution of others entirely different, as if belonging to a new order of parts.

On each of the morbid states alluded to in the preceding remarks, I shall offer some general observations, in order to avoid the repetitions which might otherwise be necessary in describing the various diseases of which they are the constituents. It is essential that they should receive specific names, so as to spare continual circumlocution. I shall employ in general well known and accepted terms. Should the meaning here attached to them differ in any respect from their ordinary acceptation, I shall at least endeavour to make their use in this work correspond with the explanation given in the outset.

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* The author does not deny that every act of every part of the living body is accompanied, as essential to its performance, with some molecular change, though this is not positively proven, and is perhaps insusceptible of proof; yet such change may certainly take place without any alteration of the organization. If one molecule, or granule, or cell disappears, and is replaced by another exactly similar, the state of the organ remains the same; there has been performance of function without change of structure. Now it is easy to conceive that this alternate destruction and repair may go on more rapidly than is consistent with a healthy state of the function; the structure of the part remaining unaffected, and the same at the end as at the beginning of the morbid process. For the sake of convenience, we may consider organic derangement as commencing when the changes of structure are such as to be discoverable by the senses, and whatever falls short of this to be functional. (*Note to the third edition.*)

That condition of super-excitation in which the functions are morbidly deranged, without obvious organic change, is called *irritation*. When the excitation is marked by peculiar characters, distinguishing it from the ordinary results of over-stimulation, it is designated as a *specific irritation*. The term irritation is also employed, even when organic changes take place, provided they fall short of that peculiar condition, usually marked by redness, heat, pain, and tumefaction, and which is denominated *inflammation*. When this condition occurs, the irritation is considered as merged in it, and the term is abandoned. Inflammation may also be marked, like the lower grade of excitation, by peculiar characters, materially differing from those which it presents in its ordinary form. Such deviations are distinguished by the name of *specific inflammations*. It is impossible in all cases to designate the precise boundary between irritation and inflammation. The lower grades of the former and the higher grades of the latter are very clearly marked; but they run together in the interval. They are merely opposite extremes of the same line of excitation.

That morbid condition in which the vital actions are reduced below the healthy standard is called *depression*. It differs from debility, which implies a loss or diminution of vital power; while, in the case of depression, this power may be undiminished, though temporarily restrained. It may consist in a simple reduction of the vital actions, or may be accompanied by peculiarities arising from the operation of peculiar causes, in which case it may be denominated *specific depression*. It may, moreover, be purely functional, or attended with organic changes. In the latter case, its lowest grade is *mortification* or *gangrene*.

Diseased conditions which are entirely peculiar are of course designated by special names, which it will be sufficient to mention when the diseases themselves are considered.

I shall proceed now to treat of the several morbid states above indicated; viz., irritation, inflammation, and depression, with their general causes, laws, and effects. As one of the attendants upon these morbid states, and deserving of notice from its frequent occurrence, as well as for the great importance attached to it by modern pathologists, I shall next consider the subject of *congestion*. The next general topic will be *fever*, which, though not elementary, is a most important constituent of numerous diseases, and, as it is perhaps incapable of analysis, may be advantageously considered among the simpler forms. Lastly, I shall treat, in a general way, of those peculiar morbid states, in which there is a complete change of the vital actions, and the production of new deposits or structures, giving rise to a series of phenomena peculiar to each of the states in question. Such are the tuberculous disease, melanosis, and cancer. Under these several heads, may be included all the constituent forms of disease, with the exception of certain morbid changes in the state of the system independent of deranged action, such as excess of the sthenic condition, debility, and excess or deficiency of excitability, which, however, may be incidentally considered in connexion with their attendant disorder of function.

Article I.

IRRITATION.

Causes, Propagation, Transfer, &c., of Irritation.—Any morbid excitement of the vital actions not amounting to inflammation is denominated irritation. This may result directly from an excess of the ordinary agents necessary for the support of health, such as food, drink, air, heat, light, and electricity; from the action of substances having acrid or stimulant properties, whether extraneous to the body, as various medicines and poisons, or produced within it, as acrid secretions, healthy secretions too long retained, products of chemical changes, parasitic animals, even the blood itself if too abundant or of altered qualities; from excessive or perverted mental action; and from various unknown causes, the existence of which is inferred from their apparent effects, as miasmata, contagion, and epidemic influence.

Irritation may also result indirectly, through certain physiological laws, which determine this condition as the necessary consequence of other antecedent conditions.

The system appears to possess a certain amount of excitability. If this be called into excessive action, it is exhausted in proportion to the excess, and there is necessity for subsequent repose in order that it may be recruited. If, on the contrary, from a diminution of the wonted stimuli, or by the action of directly depressing agents, it is allowed to rest, or is restrained, it is afterwards, upon the removal of the cause, proportionably augmented; and the amount of excitant agency, necessary under ordinary circumstances for the support of health, becomes now the cause of excessive and perhaps morbid action. Hence, depressing causes, if of temporary duration, indirectly produce irritation by the reaction which results. This is probably true of the whole system, though the fact is denied by some pathologists. It is certainly true of the several parts of the system. A familiar illustration is offered in the irritation which frequently takes place in the hand, previously exposed to severe cold, upon entering a warm apartment. A degree of heat which was before only sufficient to sustain the natural condition of the part, now that the excitability has accumulated through the sedative agency of the cold, becomes capable of producing an unhealthy excess of action. This principle is very important, and of very frequent applicability in the explanation of morbid phenomena.

There is another mode in which irritation may result indirectly from depressing causes. In the mode just described, the irritation occupies the precise seat of the antecedent depression, and succeeds it; in that now alluded to, it occurs in other organs, and is co-existent with the depression. When the healthy actions of a portion of the frame are reduced, the nervous energy and circulating fluid, being diminished in that part, necessarily accumulate elsewhere; and, if the cause continue to operate, a morbid excess of action, in other words, an irritation in some other part or organ is the consequence. This results in part from a mere change in the balance of the circulation, throwing an undue portion of blood, which is itself a powerfully stimulating agent, upon a particular organ; but probably in part also from the operation of that physiological law by which the system, possessing a certain amount of excitability, experiences a temporary increase of this property in certain parts, when its exercise is restrained in others. Thus we have, at the same time, an increase of the excitability and of the exciting agent in the same portion of the body, and irritation necessarily follows. This is an abundant source of disease. Many of the cases of internal irritation, having their origin in the external application of cold, may be considered as illustrations of the principle here stated. The blood, leaving the cutaneous capillaries, seeks certain inner parts of the body, which have at the same time acquired increased susceptibility to its stimulant action by the repression of the natural excitability of the surface; and irritation is established in some one of the organs most predisposed to that condition.

Another fruitful source of irritation in particular parts is its previous existence in other parts, with which the first are sympathetically connected. All portions of the system are so bound together by a chain of sympathies, that a strong impression can scarcely be made on any one portion, without vibrating through the whole. But each particular part or organ is more closely associated in this way with certain parts or organs than with others, which, therefore, more strongly feel its disturbances, and are more easily brought into sympathetic irritation; that one of the associated organs being attacked, in preference to the remainder, with the secondary irritation, which is from other causes most predisposed to the affection.

Continuity of parts of similar structure is most favourable to the rapid propagation of irritation. Thus, if one point in a serous or mucous membrane or of the skin becomes irritated, the disorder often spreads rapidly from that point, involving a large portion of the tissues affected before it ceases to advance. If an absorbent radicle is the seat of the irritation, it often extends quickly along the absorbent to the nearest gland, while the neighbouring parts are comparatively little affected.

Continuity even of dissimilar structure is also favourable to the spread of irritation. An investing membrane frequently communicates disordered action to the organ which it covers, and one of the membranous coats of a canal to one or more of the others. What is more common, for example, than spasmodic contraction of the muscular coat of the alimentary canal, or of the urinary bladder, consequent upon irritation of the mucous membrane?

But parts often sympathize strongly together which are distant from each other, and have no direct connexion. This happens probably through the instrumentality of the brain and spinal marrow, or the ganglia. Instances of the communication of irritation from one organ to another in this way are almost innumerable. The stomach and heart are especially rich in these sympathetic connexions, and suffer accordingly. Thus, gastric irritation, with nausea and vomiting, is a frequent attendant upon disorder of the brain, of the parenchyma of the liver and spleen, and of the kidneys, not to speak of other portions of the alimentary canal itself; while irritation of the stomach is, in its turn, almost always radiated to one or more of these organs. The heart may be thrown into sympathetic disorder by strong irritation in any part of the body. Indeed, the whole system is frequently made to sympathize directly or indirectly with the sufferings of any one of its organs; and almost every extensive disease, not resulting directly from contamination or alteration of the blood, is an example of disorder propagated from one or a few points in which it may have originated.

It sometimes happens that an irritation, thus sympathetically produced, becomes the prominent disease; that from which it originated having very much diminished, or disappeared. In this case, a *metastasis*, or transfer of the diseased action, may be said to have occurred; though this phenomenon is more frequently the result of other causes; as, *first*, of the cure of a local irritation, while the general diathesis in which it may have originated remains, and which now throws its force upon some other part, as in the case of gout in the stomach succeeding its removal from the feet by cold applications; and, *secondly*, of the establishment of an irritation in a sound part by some independent agency, calling off the irritation from its original seat, as when gout in the stomach is relieved by the application of mustard to the feet.

Sometimes, instead of diminishing or disappearing, the original irritation acquires additional force by reflection from the seat of the secondary or sympathetic disorder; as when the heart, excited by some local irritation to excessive action, sends an increased current of blood through the part affected, and thus stimulates it more highly.

The facility with which irritation may be produced depends much upon the general condition of the system. Firm and vigorous health presents the greatest resistance to the action of irritant causes. When excitability is distributed in just proportion throughout the frame, and each organ performs its function duly, the usual causes of disease, finding no weak point to assail, will often pass harmless by. Elevation above the standard of health, and depression below that standard, equally provoke the attack of diseases of irritation.

A full plethoric habit, in which the blood is excessive in quantity and too rich in quality, though the complexion may be florid, the digestion good, the nutrition active, and the other functions apparently in perfect order, is by no means an evidence of vigorous health. Such a habit is, indeed, always on the borders of disease. The slightest irritant cause is sufficient to rouse the latent tendency into action. The blood is so stimulating and abundant as to maintain every organ at its highest point of action consistent with health; and a single additional drop of excitement is sufficient to make the action run over into disease. When irritation is excited under these circumstances, it is almost certain to fall upon the blood-vessels, and is apt very speedily to rise into inflammation, unless the over-excitement be quickly relieved by abundant secretion, or by hemorrhage. Thus, persons returning from a long journey, in which exercise has invigorated their digestive and nutritive functions, and resuming sedentary habits, are exceedingly liable to inflammatory attacks. During their period of active exertion, the additional quantity of rich blood supplied by the invigorated digestion, is expended in the support of the excited functions, so that the healthy balance is preserved. But when, upon a return to comparative repose, the cause of this additional expenditure ceases, while the appetite, yet unimpaired, and the digestive function tasked to the utmost, continue the additional supply, a plethoric state of system is established, and the slightest spark is sufficient to light up the flame of high vascular irritation, if not of inflammation.

A system enfeebled by depletion, by abstinence, by imperfect digestion, or by any other cause, is perhaps not less liable to disorder from over-excitement; but the irritation in this case is apt to take place in a different order of parts, and to present different phenomena. Instead of attacking the capillary blood-vessels, and exhibiting excessive vascular action, it is disposed to seat itself in the nervous system, and to take on the form of neuralgia, spasm, convulsion, or other nervous disorder. The functions are often very much deranged without any discoverable organic affection, and with little disposition to assume the inflammatory condition. Even the heart may be thrown into tumultuous movement, without alteration of its own structure, or the existence of any known local vascular irritation or inflammation to excite it. Thus, the irritation of gout, which in the plethoric fixes upon the blood-vessels, and very generally ends in inflammation, will in the debilitated, often exhibit itself in various harassing nervous disorders; as dyspepsia, spasm of the stomach and bowels, asthma, palpitation of the heart, vertigo, and neuralgia. Hence, the system when enfeebled is often said to be in an *irritable state*, because it is easily excited into disorder, and that disorder is apt to retain the form of irritation; while an opposite condition is called inflammatory, because any irritation excited almost always runs into inflammation. But, though a state of debility predisposes especially to nervous derangement and functional irritation, it would be a great mistake to suppose that it indisposes to inflammation; on the contrary, this form of disease is more apt to occur, under such circumstances, than in perfect health.

In various diseases, particular organs acquire increased irritability, and are thrown into disorder by causes which would produce no effect in health; and parts which have already been the seat of irritation are more liable than others to subsequent attacks. An exception to this latter rule is afforded in certain diseases, usually of a contagious and specific character, which in general affect the human subject but once; such as small-pox, measles, hooping-cough, &c.

When an irritation has been produced, it often continues for a considerable time after the original cause has ceased to act. When the system or any of its parts has been thrown into agitation, time is required for it to settle down into the calmness of health; and, as with the surface of the sea after a storm, the commotion is sometimes greater after the removal of the cause than during its action. In cases, however, where the irritation assumes a permanent form, there is reason to ascribe its continuance to constitutional predisposition.

It is maintained by some writers that, as the system possesses only a certain amount of excitability, a universal irritation cannot exist, and that, even admitting that an irritant may be applied to the whole system, it can affect only a part. But this does not necessarily follow. It must be admitted that the system has a limited amount of excitability; but it is not true that the whole of this excitability is called into play in health. It is easily conceivable that, by augmenting the stimulation applied to all the organs, the excitability in reserve may be brought into action, and a universal exaltation of the vital functions beyond the point of health result. It has been objected to this view that, as there is only a fixed amount of blood, and as an increased supply of blood is a necessary attendant upon exaltation of function, a universal irritation is impossible, because in such cases the blood must be held everywhere in equilibrium, and there could be no accumulation in any one part. But, though this is true as to the amount of blood in any part at any given instant of time; yet all the effects of irritation are obtained by an increased rapidity of circulation, which may be universal. Nor is the evidence of facts against the opinion here advocated. It has not been and cannot be proved that no case of universal irritation has existed. But such a case cannot be of long duration. The excitability must soon be exhausted, and the system sink into a state of indirect depression. Nor, admitting the possible existence of such cases, can they be allowed to be common. It seldom happens that a stimulant agent is applied to the system universally, to which the peculiar and various susceptibilities of all the organs will respond, so that all shall be excited to morbidly increased action. Even when the agent is a universal stimulant, still, certain organs are much more susceptible to its influence than others; and these, being first excited into a high degree of irritation, occupy all the reserved excitability, and even call off that of the other organs to such an extent as to render them, under existing circumstances, not only insusceptible to the stimulant impression, but in a certain degree to that also of their ordinary healthy excitants, so that they are left in a state of depression. Hence, the ordinary result of the morbid operation of even general stimulants is the establishment of irritation in one or more organs and depression in others; and this is still more common when the operation of the cause, as generally happens, is partial. In the great majority of diseases, therefore, there is a mixture of these two opposite conditions; though the predominance of the irritation, or of the depression, may give the peculiar character of the one or the other to the disease in general.

The effects of irritation are often displayed in organs remote from its real seat. This happens when the disorder attacks a tissue or order of parts, upon the due action of which other parts depend for the ability to perform their peculiar functions. Thus, sensibility, muscular motion, and to a certain extent secretion, depend upon a due supply of nervous influence from the brain, spinal marrow, or nervous ganglia. Irritation, therefore, in either of these structures, or in the course of the nerves which convey their influence, may produce great disorder in one or more of the functions alluded to in any part of the body, even the most remote. Hence, paralytic, spasmodic, and convulsive affections, and innumerable derangements in the secretory functions, often depend exclusively upon disease in the nervous centres.

It is highly probable that each particular function, dependent upon nervous influence, receives its supply through nervous cords or fibrils devoted exclusively to itself, and connecting it with some particular nervous centre; in other words, with some portion of the brain or spinal marrow, or some one of the ganglia, which presides especially over it.

It has long been known that, in certain instances, the nerves of special sensibility are distinct from those of general sensibility, as in the organs of sight, hearing, and smell; and the fact is now believed to be true also in regard to taste. The fact that a certain degree of cold benumbs the sense of touch in the hand, while the sensibility to painful impressions, so far from suffering diminution, is in reality augmented, and the fact also that in certain morbid states of the system the touch is often exceedingly acute, while the sensibility to painful impressions is so far lost that needles may be run into the hand, or a tooth extracted without apparent consciousness,* render the inference highly probable, that the nerves of touch are also distinct from those of general sensibility.

It has been demonstrated by Bell, Magendie, and others, that sensibility and the power of motion depend, in many instances, upon distinct nerves, though they may be connected in the same sheath; and analogy, as well as the phenomena both of health and disease, justifies us in assuming the fact to be universal. But we may go further, and infer that each distinct part, in an association of parts devoted to the same office, has distinct nervous fibrils, by which it communicates with the source of its power; that each muscle, for example, is thus provided; as we cannot well otherwise conceive how the will could communicate with any particular muscle, to the exclusion of all the rest. We are thus provided with the means of explaining numerous morbid phenomena, and conducted to a rational mode of treatment. Almost every variety of functional derangement, in almost every part of the body, may have an origin in irritation of a single point in the brain, spinal marrow, nervous ganglia, or the nerves connecting these organs with the seat of the function; and remedies addressed to the real seat of the disease may speedily relieve it, while, if confined to the apparent seat, they can be of no advantage. The importance, to the physician, of bearing in mind the general truths inculcated in this section is incalculable.

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* As in the morbid state induced in persons of irritable nervous systems, by those operations performed under the name of animal magnetism. The author has seen too many instances of the kind alluded to in the text, to allow him to entertain a doubt upon the subject. He does not, however, wish to be understood as ascribing any other influence to these operations than one of an exclusively mental character.

Phenomena, Effects, &c., of Irritation.—The first observable phenomenon, in the lower grades of irritation, is an exaltation of the function in the part affected. With an increase of the irritation, the function becomes more or less deranged, and in the higher grades undergoes an entire change, or is altogether suppressed. The symptoms consequently vary with the tissue, organ, or series of parts affected, and with the degree of the irritation.

In most parts of the system there is a combination of capillaries, nerves, and ultimate cells or molecules, the last of which are the proper agents of the function, while the two former supply material and requisite influence. Now it is possible that the relation between the irritant cause and these several parts may be such, that the irritation may be primarily seated in one, to the exclusion of the others, or all may be affected simultaneously. But on whichever the first impression is made, though there may be a predominance throughout of its morbid action, yet the others will soon more or less participate in the derangement. The nerve tissue is certainly more susceptible of an independent irritation than the blood-vessels; and the various functions of the nervous system or its parts may be increased, deranged, or suppressed, without a direct original participation of the capillaries. Thus, the sensations may be sharpened or perverted, the emotions and intellectual operations elevated or deranged, and muscular movement invigorated, disordered, or suppressed, without any discoverable evidence of antecedent vascular change. It may, indeed, be said that the capillaries of the neurilemma, or of the nervous substance itself, either in the nervous centres, or the conducting cords, may be the seat of the irritation which thus interferes with the functions; and this is undoubtedly the case in many instances, as dissection has proved; but, in many other instances, neither examination after death, nor investigation during life, has been able to detect such a source of the irritation; and its existence should not be assumed on mere theoretical grounds. Nevertheless, in any case even of primary nervous irritation, the capillaries and elementary cells are apt to become secondarily involved; and perhaps in no case can the latter be the seat of irritation, without a speedy participation of the nervous structure; so that in most instances all partake of the disorder, and contribute to the results.

A phenomenon always present in local irritation not exclusively nervous, whatever may be its seat, is an increased flow of blood to the part, and a consequent arterial *congestion*. In relation to the immediate cause of this congestion, there will be occasion to speak when upon the subject of inflammation. Of its existence there can be no doubt. It is evinced to the eye by the redness which follows the application of an irritant to the skin, or to any other exposed part. It is one of the first steps which nature takes in that series of changes which attend a persistent irritation, and is a necessary instrument for the accomplishment of those changes. Independently of the results which flow from the vital influence of the blood thus accumulated, it frequently proves injurious mechanically by pressing upon and cramping the organ, and thus interfering with the due performance of its functions; as in the vertigo, or even apoplexy, which sometimes results from general congestion of the brain without any discoverable lesion, and the partial palsy which attends a similar congestion of the particular centre, from which the affected part is supplied with nervous influence.

An altered condition of the sensibility is another change attendant upon irritation. If the excitement be moderate, there is merely an exaltation of the natural sensibility. Thus, in the early stage and lower grades of irritation, the sight, hearing, taste, smell, and touch may become more acute when their organs respectively are affected; and the ordinary susceptibilities of particular parts to particular impressions are augmented. Very soon, however, if the disorder continues or becomes of a higher grade, the sensibility is perverted, with the occurrence of deranged sensations, or is impaired so that the appropriate stimuli do not make their usual impression, or is for a time altogether lost.

Similar modifications occur in the motive power, when the muscular tissue is affected. It is first increased, so that the muscle will act more vigorously under the same amount of stimulation; it is then perverted, so that the contraction becomes irregular or spasmodic; and sometimes it is altogether lost under the violence of the irritation, as when the heart almost instantly ceases to beat, in cases of sudden translation to it of gouty, rheumatic, or neuralgic disorder.

Digestion is also apparently invigorated under a moderate irritation, and becomes deranged as the irritation increases. Hence, most substances which are capable of inflaming the stomach, will in very small doses provoke a temporary increase of the appetite, and more rapid assimilation of the food.

Absorption seems to be somewhat variously affected. It is a general law, that the rapidity of absorption is inversely proportionate to the fulness of the blood-vessels. In capillary irritation, therefore, as the blood is usually accumulated in the vessels of the part affected, absorption should take place less rapidly than in the healthy state; and this seems to be the case. Experiment has proved that substances which highly stimulate the surface to which they are applied are less apt to be absorbed, cæteris paribus, than others which produce no such effect; and the copious effusions which take place in closed cavities, in a state of irritation or inflammation, must result from the circumstance, that the increased elimination is not counterbalanced by a corresponding activity of absorption. Whether the result is merely mechanical, depending upon the pressure of the blood in the distended capillaries, impeding the direct entrance of fluids through the coats of the venous radicles, and at the same time cramping the lymphatic vessels, or whether we are to consider that the absorbents do really not participate in the irritation, is a point which it might be difficult to decide. The fact, however, is important in a therapeutical point of view. But, though absorption is usually impeded by any irritation which has the effect of producing, in whatever degree, a congested state of the capillaries, there would seem to be cases in which an irritative action in a part is not incompatible with increased absorption; as in cases of hypertrophy, where this function, though not invigorated in the same proportion as the nutritive, must necessarily be more active than in health in order to produce the requisite symmetry of growth. Besides, the absorbents, when submitted to a direct and exclusive stimulation, obey the general rule; that is, if moderately excited, they perform their usual function more vigorously, but under excessive excitement, are deranged or impeded in their action, or cease to act altogether. Atrophy, general or local, may result from the former condition, morbid accumulation of secreted matter from the latter. It is highly probable that the kind of absorption which results from the mere physical imbibition of fluids, or endosmosis, is the only one in which irritation appears directly to diminish the process; while that effected through cell-action, which is the true vital absorption, is obedient to the general law.

The influence of irritation upon the function of secretion is of great practical importance. In all the secretory organs, its first effect, if not excessive, is to increase the quantity of fluid without materially altering its qualities. In a somewhat higher grade, it changes the character as well as increases the amount of the secreted fluid. Thus, the mucous discharge from the nostrils, which, under a slight irritation, becomes somewhat more copious, retaining its usual bland qualities, is, in a higher grade of irritation, not only increased in quantity, but so far altered in quality as to excoriate the skin over which it passes. Thus also in the action of calomel on the liver, a very small dose will often produce a moderate flow of healthy bile, while that which results from large doses is not unfrequently dark-coloured and exceedingly acrid. There are many diseases which consist essentially in increased secretion, consequent upon irritation of the secreting organs. Such frequently are diarrhœa, cholera morbus, and various forms of dropsy; and whether the character of the fluid secreted shall be the same as in health, or in a greater or less degree modified, depends often upon the degree of the existing irritation.

In many instances, the secreting organ, under high irritation, throws out blood little if at all altered, either by rupture of the distended capillaries, or through pathological openings in their walls large enough to admit the passage of the red corpuscles, of the possible occurrence of which there will be occasion to speak hereafter. *Hemorrhages* frequently have their origin in this cause.

When the irritation exceeds a certain point, the secretory process is diminished or altogether arrested; and, under these circumstances, inflammation is apt to be established.

The function of nutrition obeys the same law. It is promoted by a slight irritation, and impeded, deranged, or arrested by one of a more violent character. That condition of a part denominated *hypertrophy*, or excessive growth, appears to be the result of a mere augmentation of the nutritive process, consequent upon a moderate irritation in the part, directed probably with special force to its cellular or molecular constituent. The disorder may affect the whole of an organ, or only one or more of its component parts. Thus, the liver is sometimes enlarged, without any other apparent deviation from the healthy state. In this case, the whole organ is probably the seat of an irritative action. In other instances, the intimate structure is deranged, in consequence of the augmentation of one of its components.

To complete our general view of irritation, it remains only to call attention to its secondary effects. These may be exhibited in the part immediately affected, or in other parts of the body. In the former situation, after the subsidence of the irritation, a state of depression usually occurs, in which the functions are performed more feebly, or are for a time suspended. The fatigued organ requires a period of rest before it can return to its ordinary duties. This subject will be more fully considered under the head of *depression*. In parts of the body not the seat of primary irritation, two things may occur. In the first place, those closely connected by sympathy with the seat of the disease, frequently participate in its disorder, and become secondarily irritated. In the second place, in consequence of the limited amount of the excitability possessed by the system, parts which are affected neither with the primary nor the secondary irritation, are apt to be depressed in their action below their previous condition. We may artificially avail ourselves of this principle so as to relieve existing irritations, by establishing a more powerful one elsewhere. Upon this point there will be occasion to treat more fully hereafter.

Among the important secondary effects of irritation, are also to be considered the changes produced, and phenomena exhibited, in parts which depend for the due performance of their functions upon the regular action of the part affected. Now all the functions of the body are so closely connected, and so mutually dependent, that one cannot be materially deranged without more or less deranging the others. Hence an irritation, capable of throwing any one function into serious disorder, will interfere secondarily with others by depriving them of the influences requisite for their due performance, or engendering new influences of an injurious character. Thus, a derangement or suspension of the secretion of the gastric juice, gives rise to impaired digestion, in consequence of which less nutriment is thrown into the blood, which, therefore, becomes less capable of supplying the due material and influence to the functions of innervation, secretion, and nutrition; and thus disorder in all these functions may arise, as a secondary consequence of irritation of the stomach. This, it is evident, is a very different mode of propagating disease from that which is effected through sympathy of parts, by which the original irritation is immediately transmitted from one organ to another, retaining its primary character in its new locality. But, though there is a mutual dependence, to a certain extent, in all the functions, yet certain parts are more intimately connected than others, and in some this connexion is so close, that irritation in the one finds its legitimate expression in derangements of the functions in another. The nervous centres hold such a commanding relation with the whole system; and irritation in the brain, spinal marrow, and ganglia, is often recognized only by the disorder which it produces in the dependent functions. From what has been said in this section, it will be readily inferred that a vast number of morbid phenomena and effects are merely secondary consequences of irritation in some other part of the system than that in which they are exhibited.

Specific Irritations.—In relation to specific irritations, those, namely, in which the super-excitement deviates from the ordinary line of excessive action, few general observations can be made; as, from their very nature, they require a special consideration. In relation to their origin, propagation, and effects, they are for the most part obedient to the general laws already stated. Their peculiarity is dependent upon some peculiar diathesis or predisposition of system, which determines special effects from ordinary causes; or, as much more frequently happens, upon peculiarity in the nature of the cause. Thus, gouty and rheumatic irritation may be excited in systems, predisposed to these forms of disease, by any irritant cause; while the irritation of hooping-cough is developed, in the ordinary state of system, by a peculiar contagious principle. All contagious diseases, so far as they consist in irritation, may be placed in this category; for they are all peculiar, if in nothing else, at least in generating a poison similar in its effects to that which produced them.

Article II.

INFLAMMATION.

This name is applied to a peculiar morbid condition, usually characterized by increased redness, increased heat, pain, and swelling. The co-existence of these phenomena in any one part may be considered as sufficient evidence of inflammation in that part; although, if they persist for a very short period, there is always associated with them some modification of the secretory and nutritive processes. The absence, however, of one or more of the symptoms mentioned is not incompatible with the existence of inflammation. Thus, pain is sometimes wholly wanting, and the increased redness and heat often disappear before the inflammatory action ceases. But almost every definition of natural processes is liable to similar imperfection; for the different processes are so allied, intermingled, or overlapped, that scarcely any one is susceptible of being entirely isolated, even for the purpose of description. In this work, the term inflammation is considered as embracing all that series of local changes which commences when irritation ceases, and ends only with the loss of life, or the restoration of the part to health.

Inflammation is beyond all comparison the most important of diseased conditions; as it either attends, or forms an essential part of the great majority of serious diseases, and in very many instances constitutes the chief source of danger. Hence it requires to be studied with peculiar care. I shall treat 1. of its general phenomena, progress, and results; 2. of its nature; 3. of its causes; 4. of its modifications in the different tissues; and 5. of those varieties which may deserve to be considered as specific.

1. *Phenomena, Progress, and Results of Inflammation.*

1. REDNESS.—This is usually the first observable phenomenon. It is of various intensity and shade, according to the degree of the inflammation, its stage, the part affected, the state of the system, and the nature of the cause. Every grade of it is observable, from a light rose-colour to a deep crimson, or even purple. It may appear in points, in streaks, in minute ramifications, or quite uniform like the redness in blushing. It is generally most intense in one spot, and as it recedes from this, gradually diminishes until lost in the healthy colour; but sometimes it has an abrupt boundary, and is of equal intensity, or very nearly so, throughout. The brighter hues generally attend ordinary active inflammation; the darker, that proceeding from some specific cause, or associated with a feeble action, or a gangrenous tendency. The redness often disappears under pressure by the fingers, and returns upon the removal of the pressure; the rapidity with which it returns measuring the activity of the circulation in the part. Sometimes, however, it cannot be removed by pressure, in consequence of the engorged state of the capillaries, and the extravasation of blood. The colour of inflamed parts is owing chiefly to an enlarged capacity of the vessels, which thus admit a greater volume of blood, and to the crowding of the red corpuscles, which exist in much larger relative proportion in the vessels of the inflamed part than in the circulation generally. It also sometimes depends in part upon the effusion of blood, or the extravasation of the red fluid of the corpuscles. The intense redness exhibited in certain cases may be ascribed, as suggested by Hunter, and subsequently proved by microscopic examination, to the passage of the blood unchanged from the arteries into the veins.

2. HEAT.—With the increased redness, there is also an increased temperature of the part. This is usually more sensible to the patient than to the observer; though it may in general be detected by the hand, and is rendered evident by the thermometer; but, from the experiments of Mr. Hunter, it would appear that it never exceeds the temperature of the blood in the heart. Consequently, when a part near the centre of circulation is inflamed, the increase of temperature is less than, under similar circumstances, in the extremities, where the ordinary degree of heat is lower. Thus, according to Thomson, blisters on the chest seldom raise the temperature more than one or two degrees; while upon a remote part of the upper or lower extremities, they produce an elevation of five or six degrees, or even more. A part heated by inflammation resists the ordinary causes of refrigeration more than

in health. Thus, Hunter found that the ear of a rabbit, inflamed in consequence of previous congelation, could not be frozen anew. The causes of the increased temperature are probably the greater quantity of blood in the capillaries, and an augmentation of that vital action upon which the evolution of heat depends. Thomson advances, as an objection to the latter of these causes, that the temperature does not exceed that of the blood in the heart; but it probably exceeds that of the blood on its way from the heart to the seat of inflammation, particularly when this occupies a distant portion of one of the extremities; so that the temperature of the inflamed part cannot depend exclusively on that of the blood brought to it; and we know of no other source from which the caloric could be supplied than the vital action alluded to.

3. PAIN.—Pain is commonly felt very soon after the commencement of inflammation, and sometimes even precedes the redness. It varies exceedingly in degree and character; being, in some instances, so slight as to be scarcely perceptible, in others, exquisitely severe; sometimes sharp or lancinating, at other times dull, heavy, or tensive; sometimes throbbing, and again pungent, prickling, burning, or merely itching, as in certain affections of the skin. Occasionally, it amounts only to soreness; the patient being scarcely conscious of pain unless the part affected is pressed upon or moved; and pressure or motion aggravates the suffering in all cases. It is, moreover, liable to remissions and exacerbations, and sometimes even intermits. These diversities are owing to differences in the seat, degree, stage, and character of the inflammation, and are often useful as one of the means of diagnosis. Parts having little or no sensibility in health, such as tendon, ligament, and serous membrane, often become exquisitely painful when inflamed. The pain is frequently felt in parts remote from the real seat of disease, as in the right shoulder from inflammation of the liver, in the glans penis from inflammation of the neck of the bladder, and in the knee from inflammation of the hip.

The cause of the pain is some unexplained modification in the state of the nerves. It may be aggravated by the pressure arising from the distended vessels, or the thickened neurilema, and is in many instances increased by each pulsation of the heart, producing what is called pulsative or throbbing pain; but pressure cannot be the sole cause; as, when applied in an equal or even greater degree in health, it produces no such effect; and pain often precedes tumefaction, and is even somewhat relieved by it.

While the general sensibility is thus increased by inflammation, the special sensibility of each particular organ is diminished or suspended. The touch, taste, smell, hearing, and sight are impaired when their several organs are inflamed; and the same is the case with what have been called the internal senses. In the irritation which often precedes the establishment of the inflammatory process, the senses are sometimes rendered more acute; and the same result takes place, when a portion of the appendages of the proper organ is inflamed, and propagates only a sympathetic irritation to the nervous structure, or real seat of the sense; as, for example, in the ear and eye, in the former of which, inflammation of the cavity of the tympanum, or external meatus, is occasionally attended with increased acuteness of hearing, while the same condition of the exterior membranes in the latter may sharpen the sensibility of the retina. But these are only apparent exceptions. The general proposition remains unaffected, that the senses are impaired by inflammation established in their several organs. The finger, which, when inflamed, becomes exquisitely painful at the contact of a foreign body, loses in part or wholly the sense of touch, by which a judgment may be formed of the shape, size, and peculiar character of the same body.

4. SWELLING.—The tumefaction which attends inflammation is subject to equal diversities with the other phenomena. It is sometimes slight, as in the mucous membranes, sometimes enormous, as in the testicles and lymphatic glands. It may be circumscribed or diffused, prominent or flat, hard or soft, according to the circumstances of the case; and it varies of course in amount with the degree of the inflammation. Dependent at first on a mere increased influx of blood into the capillaries, it is afterwards greatly augmented by effusion into the structure of the part, and by a new organization or growth which takes place in the progress of the disorder.

5. MODIFICATIONS OF SECRETION.—It has been stated that, if inflammation last any considerable time, there is always some modification of the secretory process. In its earliest stage, while yet the excitement has scarcely passed the boundary line of irritation, there is usually an increase of the normal secretion of the affected organ. But when the inflammation has become established, secretion is almost always diminished, or even quite suspended. Thus, the skin becomes dry when inflamed, and the serous and mucous membranes undergo a similar change. Hence the dry cough which usually occurs at the commencement of bronchitis. But, in the progress of the disease, the secretory function is again brought into action, the secretion being even more abundant than in health, and by this very copiousness relieving, in some measure, the violence of the inflammation. Hence the mucous discharge in dysentery and catarrh, the serous effusion under the cuticle in erysipelas, and the similar effusion which takes place in the serous cavities, and the interstices of the cellular tissue. But the fluids thus effused are not precisely in their normal state. Instead of being perfectly bland, as in health, they are often acrid, irritating and excoriating the parts with which they come in contact. They are more or less albuminous, and frequently contain portions of the blood itself, or its colouring matter, to the variable proportion of which they owe their various shades of yellow, red, or brown. They are, moreover, generally mingled with coagulable lymph, and often, in the progress of the disorder, with pus; two characteristic attendants of inflammation, which require particular notice.

Coagulable lymph is a name applied by English writers to a substance exuded from the vessels of an inflamed part, which, though it escapes in the liquid form, coagulates after exudation, and is capable of becoming organized, and thus forming a new living structure. This plastic substance appears, from chemical analysis, as well as from its physiological properties, to be closely analogous to, if it be not identical with, the fibrin of the blood. It appears to be sometimes extravasated with little if any of the other constituents of the blood, but in general is mixed with serous fluid, and is probably thrown out of the blood-vessels in the form of liquor sanguinis, or fluid portion of the blood, deprived of the red corpuscles, and possibly somewhat altered in the process of exudation. Of this fluid, the fibrinous part concretes, while the albuminous portion, remaining combined with water and saline matters in the form of serum, fills and distends the cavities and interstitial spaces into which it may have been effused, or escapes in the form of flux from exposed surfaces, or those having a natural outlet.

All that is absolutely essential to the organization of the exuded fibrin is that it should be in contact with living tissue. As it first escapes it is a homogeneous, formless, transparent fluid; but very soon afterwards, if examined by the microscope, it is found to contain multitudes of fibrils, great numbers of minute granules of different sizes, and another set of minute bodies, which are often covered by a cellular envelope, and constitute what are called *exudation corpuscles*. Coagulation appears to depend upon the multiplication and interlacing of the fibrils referred to. After coagulation, the rudiments of blood-vessels speedily appear. Numerous red points are first seen; these lengthen into lines, which quickly inosculate so as to form a continuous network; a communication is formed between this and the capillaries of the contiguous tissue; and, in a wonderfully short space of time, a new structure is produced, possessing a more or less perfect organization. It may be readily conceived that, from deficient vitality in the effused fibrin, or from unfavourable circumstances in the position in which it may be extravasated, the process of organization may either never begin, or having begun, may prove imperfect or abortive. Hence it often happens that solid products are formed in inflammation, possibly out of the fibrin itself, which are amorphous and without life, and occasionally others which, though living, are altogether abnormal in their character.

Coagulable lymph is often exuded immediately after inflammation has been established. It forms solid flocculi swimming in the serous effusion, or ordinary secretion of the part; coagulates upon inflamed surfaces in patches or extensive layers, constituting what has been denominated *false membrane;* fills and consolidates the cells of the areolar and adipose tissues; and is even extravasated into the substance of membranes, rendering them rough and opaque, when they were before smooth and transparent. To this, much of the tumefaction and hardness often attendant upon inflammation is ascribable. It is the agent of important results, both favourable and unfavourable. By its mere coagulation in certain positions, as for example upon the inner surface of the larynx, it interferes with functions essential to life, and thus occasions fatal consequences. At other times, it proves useful by confining effused fluids within certain limits, and thus preventing them from spreading mischief into the neighbouring parts, as in the case of abscesses, and in that of irritating effusions into the serous cavities; or by surrounding foreign or noxious bodies with a coating by which they are isolated and rendered harmless. By its organization, the opposite surfaces of inflamed membranes are often permanently united, as in the pleura, peritoneum, and synovial tissue. It constitutes the medium through which the divided faces of wounds, when brought into apposition, are often reunited, and spaces produced by a violent solution of continuity in any portion of the body are filled up by a new growth. In each of these latter cases, the inflammation by which the effusion of coagulable lymph is produced is named by Mr. Hunter *adhesive inflammation;* but it differs in no respect from the affection originating without violence, and throwing out the same product upon the surface or in the tissue of organs. It is an important circumstance that, when separated parts are thus reunited, or lost parts replaced, the new structure partakes so far of the nature of the original, as in general not to interfere materially with the functions of the organ. Thus, in areolar tissue it is cellular, between divided tendons is fibrous, and between broken bones is bony. But some tissues are never actually renewed, as the muscular, and the proper cutaneous tissue.

Pus shows itself at a later stage of inflammation than the substance last mentioned. Very frequently the inflammatory affection ceases without yielding this product, and it is then said to end in resolution. If it persevere, however, pus generally makes its appearance, mingled at first in small proportion with the serum, coagulable lymph, or other secreted fluid, and gradually increasing till it becomes nearly or quite unmixed. The process by which it is produced is called suppuration, which is merely a step in that complex succession of morbid actions denominated inflammation. It is wrong, therefore, to say of suppuration that it is one of the terminations of inflammation, or to use the name suppurative inflammation as expressive of a distinct character of this morbid state. The period at which pus first appears varies from a few hours to many days. There is no vascular tissue of the body in which it may not be produced. It is liable to considerable diversity of character; but that produced in ordinary inflammation, in a sound state of the constitution, and called frequently *healthy* or *laudable pus*, because it often acts an essential part in the repair of injury, and the restoration of a healthy condition of parts, has the following properties.

It is a whitish-yellow or slightly greenish, homogeneous, opaque liquid, somewhat thicker than cream, of a mawkish odour, and sweetish taste. It is not ropy between the fingers, and does not readily separate into two parts by standing. It is miscible with water, but insoluble in that fluid, in which it sinks as it were in a pulverulent form. In its ordinary state, it is neither alkaline nor acid; but sometimes exhibits the former condition when taken from scrofulous abscesses, and the latter after exposure to the air. It is slow to putrefy. Hunter found it to differ from all other animal fluids which he examined, in being coagulated by muriate of ammonia. Experiments have been made in relation to its reaction with various chemical agents; but the results obtained are of little practical importance. It dissolves rapidly in a solution of caustic potassa. Upon analysis, it yields albumen, extractive matter, fatty matter, soda, chloride of sodium, phosphate of lime, and numerous other salts. The fatty matter is peculiarly abundant, constituting from 9 to 24 per cent. Under the microscope, pus appears to consist of small, round, and occasionally oval corpuscles, floating in a thin transparent liquid. The pus globules are larger than the red corpuscles of the blood, and than the greater number of the exudation corpuscles. The liquid in which they float is albuminous, and bears a considerable resemblance in chemical composition to the serum of the blood. (*Simon's Chemistry*, ii. 92.)

Pus is often mixed with blood, and in various proportions with many other substances, which modify its character, such as serum, mucus, and coagulable lymph. It is often rendered exceedingly offensive to the smell by contact with parts in a state of putrefaction, or by other causes. It differs also materially in properties, even where no difference is observable by the senses or chemical examination. The pus of syphilis, or of small-pox, cannot be distinguished from that of a common abscess, though the latter is harmless, while the former is capable of producing the diseases respectively in which it originated.

Authors are not agreed as to the precise mode in which pus is produced. At one time it was believed to be the product of a secretory process; but it has been satisfactorily shown, by means of the microscope, that no orifices exist in the coats of the capillaries through which its corpuscles could possibly escape; and it is now admitted to be produced from the exuded lymph, probably in consequence of failure in the attempt at organization, the exudation corpuscles degenerating into those characteristic of pus. It is not impossible that the fibrin of effused blood may undergo a similar change.

It is a doubtful point, whether pus is in all cases the product of inflammation. It is occasionally found disseminated in tissues, or collected together in masses, in the lungs, liver, and other parts of the body, without any evidence of inflammation in these organs during life, and without any of the ordinary appearances which that affection leaves behind it after death. Such phenomena are not unfrequently observed in the cases of individuals who have recently suffered amputation or other operation, by which a suppurative disease of longer or shorter continuance has been removed. But they are also said to be presented in some rare instances, in which no inflammatory source of pus, existing at the time, or within a short period previously, could be discovered. In the former case, the collections of pus have been ascribed to the previous absorption of that liquid from the suppurative source, and its subsequent deposition in distant parts. But, with our present knowledge of the constitution of pus, and the structure of blood-vessels and absorbents, it can scarcely be allowed that the corpuscles of the former can find either entrance or exit through the coats of the latter; and, if pus has occasionally been found in veins and absorbents proceeding from the neighbourhood of purulent collections, its presence is to be ascribed rather to its production within these vessels than to its entrance into them from without. It is not impossible, however, that pus may sometimes enter blood-vessels or absorbents through ulceration or other pathological openings made through their walls. Some ascribe the deposits of pus above mentioned to inflammation in the lining membrane of the veins, or blood-vessels in general, terminating in suppuration; but we are here again met by the difficulty of accounting for the passage of the pus corpuscles through the continuous and unbroken coats of the capillaries, in the act of deposition. The probability appears to be that, under the influence of various matters absorbed into the veins, or otherwise entering the circulation, the fibrin or organizable constituent of the blood may undergo such a degradation in character, as to provoke its elimination, and, when it is eliminated, to cause its conversion into pus, as when thrown out in certain stages of inflammation. Where the affection proceeds from any suppurative focus previously existing, the pus, degraded into an absorbable sanies, and then entering the veins or absorbents, may act as a ferment in inducing the change referred to in the fibrin.

When suppuration is established, the violence of the inflammation abates; and hence its occurrence has been erroneously considered as one of the terminations of inflammation. The pus may appear upon the free surface of membranes, or diffused in the interstices of the tissues, or collected together within the substance of the different structures, forming abscesses.

6. Modification of Nutrition, or Changes of Structure.—Along with the modification of the secretory process, the nutritive also undergoes material change. Not only is the inflamed part increased in size and density by the congestion and effusion which take place, but it often also becomes the seat of a new growth, as already explained, by the organization of the coagulable lymph.

Softening.—At the same time that the dimensions and density of the part are augmented, there is almost always, in acute inflammation, a diminution of cohesion, so that the texture is more easily torn than in health. This occurs even in the early stage of the inflammatory process; in the more advanced stages, the softening usually increases; and, in some instances, the healthy tenacity of the texture is so much diminished, that after death the finger may be passed through it almost without resistance. This softening often ends in a complete disorganization of a portion of the inflamed texture, which appears to break down, and is either removed by the absorbents, or dissolved in the pus, with which it seems to become identified.

Induration.—It rarely happens that a part is hardened in a state of acute inflammation. It is necessary, however, that density should not be confounded with induration. In the former, there may be greater weight and greater closeness of texture; but this is entirely consistent with increased friability. In hardening, on the contrary, the part is not only more dense, but it resists more firmly every mechanical agency that may tend to indent, rupture, or divide it. It is torn or cut with greater difficulty, is often sonorous when struck, and emits a peculiar sound under the knife. Density is often present in acute inflammation, hardening, as before mentioned, seldom. It often, however, attends chronic inflammation, and is left behind when the inflammation ceases. In these cases, it arises from an organization of the coagulable lymph effused into the interstices of the tissue affected, and a consequent consolidation of that tissue, by the union of its surfaces.

Ulceration.—Though, during the existence of acute inflammation, the absorption of foreign bodies from the part affected is much less vigorous than in health, interstitial absorption appears often to be invigorated. Whenever fat is present in an inflamed part, it is, according to Gendrin, very quickly absorbed. A solution of continuity in the tissue affected is not unfrequently a result of the same process. This may occur upon the free surface of organs, in which case ulcers are produced, and the process is called ulcerative absorption, or ulceration. It may also happen in the interior of the tissues, preparing a receptacle for the pus, and making a way for the resulting abscess to the surface. In the latter case, Mr. Hunter denominated it progressive absorption. There seems to be little difference in the character of the process in these two cases. Another opinion as to the nature of ulceration is at present entertained by some pathologists. Denying the action of the absorbents in the case altogether, they maintain that the loss of substance is owing to the disintegration and liquefaction of the tissue, which thus separates from its attachment, and is either thrown off from surfaces, or collected along with the pus in the interior of the structure.

If we admit ulceration to be the result of an absorbent action, its probable cause is, in most cases, such a diminution of vitality, under the inflammatory process, as to lessen the resistance to that action, which is always going on even in health, but is then properly balanced by a due condition of the other functions. When a part dies, if the neighbouring parts are not too much debilitated, the absorbents immediately begin to remove it. When a part approaches death, the same operation commences in the more vigorous, or less exhausted structure, in contact with it. Certain specific inflammations are peculiarly disposed to ulceration; and it is more apt to occur, other things being equal, in a debilitated or depraved than in a sound state of health. Pressure also promotes it. Acute inflammation, supervening on chronic, is very apt to be attended with it, as the already debilitated part cannot resist the new excitement.

Ulceration upon exposed surfaces, as upon the skin and alimentary mucous membrane, which are peculiarly liable to it, usually commences in a single point, producing a small ulcer, which gradually spreads till it reaches its limits. Sometimes, however, it commences in several points at once, or in succession. It is frequently attended with a pricking pain, which varies very much in different tissues, and different varieties of inflammation. Occasionally, it is very slow and of very small extent, and again is exceedingly rapid and destructive. In the latter case, it is commonly denominated *phagedenic.* It occurs in every texture susceptible of inflammation. In bone, it constitutes *caries.* It is improper to say that inflammation terminates in ulceration. The latter is merely a step in the former complicated process, and is always attended with other marks of inflammation. It is by the coagulable lymph thrown out by the inflamed capillaries, and organized, that fatal hemorrhage is prevented from occurring from the divided vessels. Ulcerative absorption may precede suppuration, but it is almost always very speedily followed by the secretion of pus. When the ulceration ceases, the loss is restored, and the parts return to health by the process of granulation.

Abscesses.—It has been stated that pus may be collected in cavities, in the interior of the different structures, and that these collections are called abscesses. This, in fact, is the ordinary result of suppuration, where there is no natural outlet for the pus. The cavities which receive these collections are made, either by the absorption of the softened tissue, or by the breaking down and decomposition of the tissue, and its solution in the pus, or by the two agencies combined. After the abscess has been formed, it has a tendency to advance towards the surface of the body. This is an undeniable fact, for which it is easier to find a reason than a cause. The object undoubtedly is that the pus may have a safe outlet. What is the immediate agency by which this outward direction is given has not been ascertained. On all sides, the abscess is surrounded with a barrier of the neighbouring tissues, consolidated by coagulable lymph, or of the lymph itself, organized and converted into a pseudo-membranous cyst or sac, which has the properties of absorption and secretion. But in that portion of the walls of the cavity which presents towards the surface of the body, ulcerative absorption takes place, preceded by the adhesion of the tissues to be absorbed, so as to confine the pus within its destined route. At length, the whole of the parts intervening between the abscess and the cuticle being removed, this is ruptured, and the pus discharged. Along with it, are frequently discharged portions of solid matter, sometimes resembling membrane, though unorganized, and consisting probably in chief of coagulated fibrin.

Where a dense tendinous or fibrous fascia, which is of very difficult absorption, intervenes between the abscess and the surface of the body, or any other obstacle exists to the direct outward passage of the pus, this fluid frequently makes for itself a circuitous route, and often produces great mischief in its course, by occasioning the absorption of textures which most readily yield to this process, as cellular substance, muscle, and even bone.

Sometimes, instead of reaching the surface of the body, the abscess opens into one of the interior cavities, and commits great havoc by the inflammation excited in the parts with which the pus comes in contact. Sometimes, also, the barrier of coagulable lymph, which usually confines it, is defective or altogether wanting; and the pus, escaping into the cellular tissue, travels to a considerable distance, destroying, and, as it were, dissecting out that tissue from the midst of others which have greater power of resistance.

When an abscess is discharged, it not unfrequently happens that the edges of the orifice are absorbed, and an open ulcer produced. But an abscess from which the pus has a free escape, is in no respect different from an ulcer, except in the greater protection which it enjoys from the action of the air. It presents a similar suppurating surface, and is filled up by a similar process of granulation.

Gangrene and Mortification.—In the course of an attack of inflammation, a portion of the diseased structure sometimes loses its vitality, and passes from under the influence of physiological to that of chemical laws. This loss of life in a part is denominated mortification, the resulting condition gangrene or sphacelus. Many writers, however, following Galen, make a distinction between gangrene and sphacelus, applying the former term to the state which immediately precedes the absolute death of an inflamed part, the latter to that which exists after its death. There is some convenience in this division; as we frequently have occasion to refer to that condition in which mortification, though strongly threatened or inevitable, is not completely accomplished. But this condition is, in fact, nothing more than one of the phases of inflammation, and can scarcely receive a distinct name without some confusion. In using the term gangrene, therefore, I shall consider it as applicable to parts already dead; though the epithet *gangrenous* may sometimes be employed as expressive of a state allied or approaching to gangrene.

The immediate cause of gangrene, in inflammation, is probably a disproportion between the excitement of a part and its powers of vitality, the latter being entirely exhausted by a great excess of the former. If the life of a part is feeble, a comparative slight elevation of its actions may produce its death; if vigorous, a great excess of excitation is requisite to this result. Whatever, therefore, weakens a part, or excessively excites it, may dispose to gangrene; and those parts are most liable to this condition which are naturally the weakest. There are certain states of system, and certain diseases, which are characterized by a universal reduction of vital power, and in which inflammation is very apt to run into mortification; and there appear to exist certain specific inflammations, which are much more liable to this result than inflammation of the ordinary character. The blood also is sometimes in a condition which strongly predisposes to gangrene, probably because it is unable to afford those supplies of material, and that healthy stimulus, which are requisite to vigorous health. Gangrene, moreover, may occur from obstruction to the circulation in the capillaries of the inflamed part.

The approach of gangrene, in parts that can be seen, is usually marked by sufficiently striking phenomena. The circulation, though it still goes on in the larger vessels, is much more languid, and, in a portion of the capillaries, is nearly or quite suspended; the colour becomes much darker, assuming a purple-red or even livid hue; the sensibility is in general diminished, though a sense of burning is usually experienced, and very severe pain sometimes immediately precedes mortification; the temperature is lessened; the tumefaction, though often somewhat augmented, is attended with a softness and flaccidity not before existing, and is apt to have a doughy feel; and a dark, bloody, turbid serum is effused into the interstices of the affected tissue, or upon its surface. Absolute gangrene is evinced by a total cessation of circulation so that the part will not bleed if cut into, an entire loss of sensibility, a change of colour to black, grayish, or livid, and a loss of the natural heat, unless in so far as caloric may be supplied from the neighbouring parts. At a period after the death of the part, differing according to the degree of exposure to the air, the temperature, and the amount of fluids present, chemical changes take place, attended with the evolution of fetid gases, constituting what is commonly called putrefaction. In this condition, the tissues are very much softened, so as to be easily broken or torn, and have their interstices filled and often distended with fetid gases, and with brownish, turbid, and offensive liquids. But putrefaction must not be confounded with mortification. The latter often takes place a considerable time before the former makes its appearance; so that the absence of an offensive smell is no proof that mortification has not occurred. Still, as spontaneous decomposition begins sooner or later, and as parts which have entirely lost the ordinary signs of life sometimes resume vital actions and return to health, it is safest, as a general rule, not to admit the existence of gangrene, unless some evidence of decomposition is presented.

Inflammation never ends with the occurrence of mortification, unless the patient dies at the same time. On the contrary, this process is necessary for the repair of the injury sustained. The mortified part is encompassed with a border of inflammation, which, in parts open to inspection, appears as a red line, dividing the living from the dead structure. The immediate cause of this inflammation is probably the excitation produced by the contact of dead, and therefore foreign matter. It speedily results in ulceration, by which the mortified part is separated, and, if upon the exterior surface, or a surface communicating externally, is thrown off in the form of what is denominated a slough. An ulcer is thus left, which presents a suppurating surface, and is filled, as other healthy ulcers, by granulations. An account of mortification, occurring from other causes than inflammation, will fall properly under another head.

Granulation and Cicatrization.—It has been stated that, after the formation of sores by ulcerative absorption, after the opening of abscesses, and after the separation of dead parts from the living in cases of mortification, a process of repair is commenced, called granulation, by which the loss is supplied, and the diseased parts return to health. This consists in the exudation of coagulable lymph upon the diseased surface, and the organization of this lymph into small, red, shining conical eminences, forming a new surface, which becomes the seat of a similar action, and so on successively till the cavity is filled up to the due level. At least this is the view which appears to be taken by Hunter. According to Macartney, however, though granulations may sometimes be formed out of exuded coagulable lymph, they are usually the product of deposition and organization, going on simultaneously, as in ordinary growth. The process is generally, if not always, accompanied with the formation of pus, which covers, and in some measure protects, the new and tender growth. It is a step in the progress of inflammation, which is now directed towards health. That the action is essentially inflammatory is proved by the elevation of the temperature above that of surrounding parts, by the increased vascularity of the surface upon which the granulations form, and by the production of pus.

Three conditions have been mentioned above in which granulation takes place. A fourth is presented by wounds, the surfaces of which cannot be brought into contact, or, if brought together, fail to unite directly by the adhesive inflammation, or first intention. But this subject belongs exclusively to surgery.

Granulations have a strong tendency to unite. Hence, when developed, they coalesce, producing a constantly increasing contraction of the granulating surface; so that, when the process is completed, the extent of the surface is usually much less than at first. If, moreover, two granulating surfaces are brought into contact, they are frequently joined together by the union of the opposite granulations. This mode of union is called by surgical writers *union by the second intention*, while to that in which the divided edges coalesce through a layer of coagulable lymph, without pus or granulations, the name of *union by the first intention* has been applied. As Mr. Thomson has correctly observed, there does not seem to be a great difference between these modes of union. Both are effected through the effusion and organization of fibrin; and the only distinction is that, in the one case, the fibrin assumes a grain-like form, and pus is secreted, while these circumstances are wanting in the other. This is not the place to consider the question whether the edges of wounds, as has been maintained, can unite by the first intention without inflammation. The solution of this question belongs to the surgical writer. The new structure, resulting from the granulating process, often resembles the one of which it is intended to supply the loss, but is seldom identical with it. It contains not only blood-vessels, but nerves and absorbents also; as may be inferred, in relation to the former, from the sensibility of granulating surfaces, and, in relation to the latter, from the ulcerative absorption which frequently occurs in them.

When, in the progress of the process of reparation, the granulations have reached the level of the neighbouring surface, they cease to grow, lose their granular aspect, become flat at top, and gradually cover themselves with a coating somewhat analogous to that which had originally existed. By English surgeons the name *cicatrix* is applied to this new superficial structure, and *cicatrization* to the process producing it. Thus, in the healing of ulcers upon the surface of the body, the formation of the new skin is called cicatrization, and the new skin itself a cicatrix. Some of the French writers extend the signification of these terms much further, including under the former the whole process of reproduction, and under the latter the whole of the new structure. There is a convenience in giving the term cicatrix such an extension as to embrace those evidences which the union of separated parts, and the reparation of lost parts, leave behind to indicate their having taken place. We frequently have occasion to refer to such evidences, discovered after death in the interior structures, and it is well to have a general name by which they may be designated. But the term cicatrization is here restricted to the process first alluded to.

Summary.—It may not be improper to present a brief summary of the course of inflammation, so that it may be taken in at one view. The first evidences of its existence, as a general rule, are unusual redness and heat, with pain and swelling in the part. The secretions are first increased, then diminished or suspended, and again restored with much alteration. The liquid part of the blood or liquor sanguinis is effused, with more or less of the colouring matter, and frequently blood itself little if at all altered. More or less of the coagulable lymph or fibrin of the effused liquor sanguinis coagulates, while the serous portion, or that remaining liquid, is diffused in the interstices of the tissue, the former being most abundant in the central portion of the inflammation, and the latter in its borders. In this condition, the coagulated fibrin becomes the seat of organic action, resulting in the formation of new blood-vessels connected with the previously existing capillaries, so that a sort of growth takes place in the part. There is, at the same time, in acute inflammation, and generally even in chronic, a softening of the structure, so that it may be more easily torn or broken. Should the progress of the inflammation now cease, the redness, heat, pain, and swelling begin to abate, and gradually disappear, the effused fluids are absorbed, and the parts return to their former condition, except that some hardness is occasionally left behind, especially in chronic cases, arising from the solidified fibrin. The inflammation is then said to terminate in *resolution*. Frequently, after a somewhat profuse secretion or hemorrhage, the inflammatory action ceases; and the same result occurs in those cases in which the exuded coagulable lymph serves as the bond of a vital union between surfaces naturally distinct, or produced by violence. In the former case, the inflammation is said to terminate in *effusion*, in the latter, in *adhesion*. It is obvious, however, that the effusion and adhesion are mere effects of the inflammatory action, and should not be considered as its terminations.

Should the inflammation persist, a new condition of things denominated suppuration takes place. The redness diminishes, the softness increases, and pus gradually mingles with the other fluids, or takes their place upon the surface, or in the interstices of the tissue. In the latter case, portions of the tissue are broken down, and either absorbed, or dissolved in the pus, which is usually collected in cavities; while, in the parts around these cavities, coagulable lymph exists, as in the earlier stage, and forms a barrier to the diffusion of the purulent liquid. These cavities are called abscesses. By means of ulcerative absorption, a passage is then made for the pus externally. Sometimes absorption takes place in an inflamed part, producing an open sore, which is then called an ulcer, while the process is denominated ulceration. Sometimes a portion of the affected tissue or tissues undergoes mortification, or, in other words, loses its life, and is separated from the other parts by absorption, leaving an open and suppurating ulcer. According as one or another of these various conditions is presented, the inflammation is said to terminate in *suppuration*, *ulceration*, or *mortification*. But the fact is, that these are mere incidents in the progress of inflammation, which in the first two persists during their whole course, and in the last continues in the parts which have not lost their life, and is necessary for the separation of the dead parts. Neither of these, therefore, can strictly be considered as terminations of inflammation.

The cavities of abscesses and ulcers, as well as those left by the sloughing of mortified parts, are filled up by a growth of granulations, which, when completed, cover themselves with a kind of skin or membranous structure, or in other words undergo cicatrization. Granulation and cicatrization have been considered as terminations of inflammation; but with as little reason as the phenomena or actions above alluded to. They are merely the last acts of this complicated process, which cannot legitimately be said to have any other termination than in resolution, that is, spontaneous subsidence, or in death.

Such is the usual course of inflammation, so far as regards the parts in which it is seated. The period occupied by this course is exceedingly variable. Sometimes it is accomplished in a few days, and possibly in a few hours; sometimes it requires weeks, months, or even years for its completion. When protracted, it is denominated chronic inflammation, which is for the most part a mere continuance of an acute attack in a mitigated form, though not unfrequently the grade of excitement is at the commencement scarcely higher than that which is sustained throughout.

Chronic inflammation is susceptible of all those diversities of action which have been already mentioned as characteristic of inflammation in general, though it is less apt to be attended with gangrene. There is frequently little or no observable increase of redness or heat, the pain is less than in the acute, and the tumefaction differs often in being attended with induration instead of softening of the tissues. It owes its protracted duration usually to one of two circumstances, either to the continued operation of the cause, as where chronic gastritis is sustained by the habitual use of stimulating drinks, or to the existence of some peculiar diathesis, as the scrofulous, which predisposes to a slow march of the inflammation. The nature of the part also has some influence, certain parts being more disposed to the chronic form than others. There is no precise boundary line between the two states of inflammation.

Some writers make a grade of inflammation between the acute and chronic, which they call *subacute inflammation;* and this term is convenient, as expressive of a condition in which the morbid action exceeds but little that which occurs in the chronic form, but is of a comparatively short duration, so that the case cannot come under this denomination, while it is excluded from that of the acute by the mildness of its symptoms.

Sometimes inflammation runs its accustomed course, so far as relates to its effects upon the texture in which it is seated, with scarcely any of those evidences by which its existence in the interior parts of the body is usually detected, such as pain, disordered function, and constitutional disturbance. Under these circumstances, it is said to be *latent*, and often escapes attention until serious injury has been inflicted. This is most apt to occur in persons with little excitability of system, arising either from original constitution, from modes of life, or from previous disease. According to Dr. Alison, it is more frequent in the black than in the white, in the old than in the young, in the poorly fed than in those of luxurious habits; and is not uncommon in convalescents from acute diseases. Sometimes, however, the absence of pain and other obvious symptoms is ascribable to the simultaneous existence of some other disease which blunts or destroys the sensibility, as typhoid fever, for example, and paralytic affections.

7. EFFECTS OF INFLAMMATION BEYOND ITS PRIMARY SEAT.—Our attention has hitherto been directed to the local phenomena of inflammation. But its effects are by no means confined to its original seat. If severe or extensive, it always involves other parts, or the system at large, in disorder. As the functions of the inflamed organ are impaired or suspended during the existence of the inflammation, other dependent or connected functions must necessarily suffer; and this is a fruitful source of derangement. The physician should always be on his guard upon this point; as it is by the observation of these secondary effects alone that he is, in some instances, enabled to trace inflammation to its real seat; and the effects themselves occasionally require his interference for their relief. Again, the vitiated products of an inflamed organ often occasion disorder in the parts with which they come into contact; as when the acrid bile from an inflamed liver produces diarrhœa by irritating the mucous membrane of the bowels, and acrid urine from the inflamed kidneys occasions irritation throughout the urinary passages. But, independently of these sources of derangement, inflammation produces other very important effects beyond its immediate seat, which I shall now proceed to notice.

Effects upon the Blood.—The character of the blood is considerably modified during inflammation. The most striking result of the change is that peculiar appearance called the *buffy coat.* This is a whitish, or yellowish-white, and sometimes greenish stratum, formed upon the upper surface of the blood during coagulation. Soft and viscid at the commencement of the coagulation, it is fully formed when the clot begins to contract and separate from the sides of the vessel, but does not attain its greatest density till the contraction of the clot is completed. It is then firm, elastic, diaphanous, strongly adherent to the cruor beneath, and shining upon its surface, which is often elevated at the edges and depressed in the centre, giving it a *cupped* appearance. Sometimes the coating remains soft and gelatinous, like size; and hence the blood which exhibits it is occasionally called *sizy blood.* The buffy coat consists of fibrin with some serum mechanically intermingled. The proportion of fibrin in the clot beneath is much less than in the crust; and sometimes, when the latter is thick and firm, the remainder of the clot is very soft, and apparently consists almost exclusively of red corpuscles.

It is a question how far this appearance is characteristic of inflammation. Though very generally presented by the blood of patients labouring under that affection, it is in some instances wanting; and it has been observed where no inflammation existed, as in the advanced stages of pregnancy, and in cases of anæmia, in which the proportion of red corpuscles is deficient in relation to the fibrin. But, with these exceptions, it may be considered as a sure evidence of inflammation. Out of eighteen hundred cases in which the blood was examined by Andral, it never had the buffy coat except in inflammation or anæmia. The cause of the buffy coat was conjecturally referred by Hunter to a slower coagulation of inflammatory blood, allowing the red corpuscles to subside in some measure before the clot was formed; and he inferred from an experiment that the red corpuscles themselves are heavier in inflammatory than healthy blood. Gendrin, however, asserts that in the blood of inflammation the coagulation begins sooner, and is sooner completed than in that of health; and, though this is not universally true, it certainly is so occasionally in cases which exhibit the buffy coat. Yet, from numerous experiments of this author, it may be inferred that whatever causes a more rapid coagulation of inflammatory blood interferes with the formation of the buffy coat, and that, when it coagulates very speedily, this coat is not exhibited, because the red corpuscles have not the opportunity to subside before they are firmly embraced by the fibrin. Thus, when blood issues drop by drop from the orifice, or falls a great distance through the air, or is received in shallow or refrigerated vessels, it is less apt to show the buffy coat than under opposite circumstances; and, if agitated continually as it falls into the recipient, it does not exhibit the coat at all. The inflammatory crust is most striking when the blood is received in a deep, narrow, cylindrical vessel.

It not unfrequently happens that the first blood drawn, in an inflammatory case, is destitute of the buffy coat, while the portions subsequently taken exhibit it strongly. At the same time that the clot presents this appearance upon the surface, it is usually less bulky and firmer than in health, owing probably to the greater contractility of the fibrin.

It has been satisfactorily shown, by the experiments of Andral and Gavarret, that the proportion of fibrin in the blood is very generally if not always augmented in inflammation, when sufficiently severe or extensive to affect the system. From three parts in a thousand, which is the average proportion in health, it rises in ordinary cases to six or eight, and in some to nine or even ten parts. The increase commences as soon as the inflammation is established, and ceases only when the process begins to decline. Even in anemic cases, and in low fevers in which the tendency of the disease is to a diminished proportion of fibrin, this principle becomes abnormally abundant when inflammation supervenes. With the increase of fibrin, the proportion of the red corpuscles remains unaffected. It has before been stated that, according to some experiments, the albumen is diminished; a result which, if true, may be reasonably ascribed to its conversion into fibrin. There can be little doubt that the formation of the buffy coat is connected with this excess of fibrin. Hence, it is often not observed in the first portion of blood drawn early in the disease, because the fibrin is not yet sufficiently abundant. In anæmia, the only other disease in which the buffy coat is observed, though the quantity of fibrin may be abnormally small, it is yet generally if not always in excess in relation to the red corpuscles. According to Andral, the fibrin newly formed in inflammation coagulates more slowly than the old. (*Patholog. Hæmatol.*, Am. ed., p. 61.)

But another cause of the buffy coat, co-operating with excess of fibrin, is probably a tendency of the red corpuscles in the blood of inflammation, first clearly noticed by Wharton Jones, to cohere by their flat surfaces, and thus arrange themselves in columns. By this tendency they are at the same time separated from the fibrin, and rendered more compact so as to sink more readily; and consequently present the very condition requisite for the production of the phenomenon in question.*

In cases of indirect prostration consequent upon great intensity of inflammation, the blood first drawn may be without the buffy coat, though it afterwards presents this phenomenon when the pulse and the heat of the surface rise, as they often do in such cases, under the use of the lancet. But, even at first, it is very different from the blood of patients in the direct debility of malignant or gangrenous diseases. In the former, though the clot forms slowly and is not dense, it is quite distinct from the serum; while in the latter, the serum is coloured by a blackish matter which subsides to the bottom of the vessel, and the clot is often completely dissolved, or not at all formed.

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* The production of the buffy coat through excess of the fibrin may be hypothetically explained. We may suppose a certain affinity to exist between the fibrin and red corpuscles, which, in their ordinary proportion, retains them in connexion, but, when the fibrin is in excess, is insufficient to prevent the corpuscles, which are specifically heavier, from sinking to the bottom along with the normal proportion of fibrin, and leaving the excess of the latter floating alone upon the surface. This explanation is applicable to all the cases in which the buffy coat is observed. The cohesive tendency of the red corpuscles among themselves, is not sufficient to explain all the phenomena connected with the case: as anemic blood exhibits the same tendency to the buffy coat as the inflammatory.—*Note to the tenth edition.*

Though the increase of fibrin and the appearance of the buffy coat, are incident to inflammation in all parts of the body, they are most striking in acute articular rheumatism and pneumonia.

In examining the appearances of inflammation in the web of a frog's foot, some microscopists observed a remarkable excess of the colourless or white corpuscles of the blood, easily distinguishable in cold-blooded animals by their spherical shape from the red corpuscles, which in these animals are oval. It was hence inferred that one of the changes produced in the blood by inflammation is to augment the number of the white corpuscles; and, as these are believed to be rudimental blood-cells, it was naturally thought that this change was an important feature of the process, and available in the explanation of many of its phenomena. But the conclusions were premature. From the observations of Wharton Jones and Professor Bennet of Edinburgh, it appears that this excess of white corpuscles is not an ordinary attendant upon inflammation, being seen only in young animals or those of feeble health or badly nourished, in which they are abundant in the circulation generally, altogether independently of the inflammatory process; and Mr. Paget states that he has often examined the blood of inflamed parts in warm-blooded animals, without ever having observed a greater proportion of the white corpuscles than in other parts of the same animals. In the present state of the inquiry, therefore, an excessive production of the white corpuscles in inflammation cannot be admitted as an established fact, at least of general application.

According to Simon of Berlin, and MM. Becquerel and Rodier, the proportion of the fatty matters of the blood is notably increased in inflammation.

Effects upon particular Organs.—It has already been stated that the interruption or disturbance of function in any one organ, occasioned by inflammation, necessarily produces derangement in other associated or dependent functions. Another source of disturbance, in organs not immediately the seat of inflammation, is the concentration of the circulating fluids and nervous energy in the part affected, which leads to a deficiency of these vital agents elsewhere. This subject has been considered under the head of irritation. A third source of disorder is the sympathetic connexion between different parts of the body, by which a derangement in one is directly followed by derangement in another, independently of any peculiar relation between their functions. This is not the place to speak of such effects; as they may be more advantageously treated of under the heads of the phlegmasiæ of the several organs or structures respectively. It may, however, be proper here to mention that the sympathetic affection may either amount to inflammation, or, as very often happens, may not exceed the grade of irritation. Positive inflammatory action is most readily communicated, as a general rule, to organs in the immediate neighbourhood of the part first affected. In spreading, it makes its way with greatest facility through identical and continuous structures, as from one point in the skin to the surrounding parts of the skin, from a particular spot in a membrane to the surrounding parts of that membrane, and from a point in arteries, veins, or absorbents, along the course of these vessels respectively. It passes also readily, though less so than in the former case, between connected but distinct structures, as from the skin to the cellular membrane immediately beneath it, and from the investing membranes of the viscera to the adjacent parts of the viscera themselves. Contiguous parts are, moreover, very liable to this direct communication of inflammation, as in the instances of the opposing surfaces of the pleura or peritoneum, in which inflammation very often passes from one to the other, without travelling through the portion of membrane connecting these surfaces. When distant parts are sympathetically affected, the secondary disorder most frequently stops short at the point of irritation.

Constitutional Effects.—Symptomatic Fever.—When inflammation has attained a certain degree of intensity or extent, it brings the whole system into derangement, causing that general condition which has been denominated fever, and which, occurring under these circumstances, is distinguished by the name of *symptomatic fever.* This general derangement may be in great measure attributed to that interruption of associated or dependent functions, that irregular distribution of the circulating fluids and nervous energy, and that sympathetic affection of proximate and remote organs, which were alluded to in the preceding paragraph as among the results of inflammation. It may in part, also, be ascribed to the changed condition of the blood; and it has been observed that the excess of fibrin uniformly appears when the inflammation is sufficient to produce fever, and disappears when the fever ceases. (*Andral.*) But there is probably some further, and yet unexplained mode of action, by which fever is produced as a consequence of local inflammation. The character of the fever varies exceedingly with the grade and stage of the inflammation, the nature of the cause producing it, and the predispositions of the patient. It partakes, indeed, of all those diversities which are incident to fever arising from other causes. Thus, in relation to its type, it may be intermittent, remittent, or continued; in relation to the state of the constitutional forces, it may be sthenic, asthenic, or of any intermediate condition; and, in relation to its grade, it may present every shade of diversity from a scarcely appreciable derangement, to the most fatal malignancy. A detailed account of these various forms would be premature in this place. (See *Fever.*) It is sufficient here to say, in addition, that when the inflammation is severe and sudden in its onset, the constitutional symptoms generally make their appearance very speedily, and are often, so far as can be observed, simultaneous in their commencement with the inflammation. In subacute and chronic inflammation, the fever is much less than in the acute, and is sometimes quite wanting; and the same is the case in those instances in which the inflammation is said to be latent. If the onset of fever should precede that of inflammation, as sometimes happens, the former cannot properly be considered as symptomatic of the latter. In this case, either the inflammation is the consequence of the fever, or both have the same cause.

Hectic Fever.—The advanced stages of inflammation are frequently attended with a peculiar morbid condition of system, which must be noticed here; as no other opportunity will be offered of giving it a distinct consideration. I allude to the affection denominated hectic fever (from ἑκτικος, habitual). It is not usually met with until after suppuration has taken place, and is much more common in the chronic than in the acute form of the disease. It scarcely deserves the title of fever, as the term is defined in this work; for it wants the universality which characterizes that affection. (See *Fever.*) Thus, the functions both of the stomach and brain are often unaffected; and the only derangements essential to it are those, primarily, of the circulation and calorification, and secondarily, of secretion and nutrition. At all events, it is but an imperfect fever. It usually begins with increased frequency of pulse and heat of skin, occurring generally towards evening, and subsiding before the beginning of the next day. The heat is especially felt in the hands and feet. After some time, the excitement of pulse continues, in a greater or less degree, through the day, with exacerbations in the evening. At length, decided paroxysms occur, often preceded by chills, and subsiding with perspiration, though both of these accompaniments are not unfrequently wanting. Generally, there is only a remission of excitement between the paroxysms; but sometimes, a perfect intermission. The paroxysms usually occur daily, sometimes in the morning after breakfast, but more frequently in the evening, when they are commonly most severe. Occasionally they occur twice a day, and not unfrequently cease for a considerable time, to return with their former violence. They are very irregular.

When the hectic is fully formed, the pulse is generally very frequent, often, during the paroxysm, as much as 120 in the minute, and, even when not frequent, is rendered so by slight causes. It has little strength, but the beat is often quick, jerking, and as if the result of irritation upon a weakened heart. The heat of skin during the paroxysm is considerable, and sometimes distressing, though often unequal; the respiration is hurried, the face flushed, the eyes sparkling, and the whole surface dry. There are also dryness of the throat, and thirst. The appearance of the face is often highly characteristic. With a general paleness, there is a bright red and not unfrequently circumscribed flush upon the cheek, such as is apt to occur in delicate persons when they lie with the cheek upon the hand, or pressed against any other hard body. This is the more striking from its contrast with the clearness of the conjunctiva, and the whiteness of the rest of the skin. Another characteristic of the affection is a tendency to copious perspiration at night, especially towards morning. This often happens whether the patient sleeps or not; but is usually most abundant during sleep. It shows itself especially upon the head and upper part of the body. The urine is for the most part scanty and high coloured, and sometimes deposits sediments, though it varies much in all these respects. The appetite is usually unimpaired, unless the stomach is the seat of the local disease. Sometimes it is even increased. The tongue is often clean; but is apt to be smooth, especially in the last stage, when there is not unfrequently a tendency of the whole mucous membrane of the mouth and fauces to throw out a thrush-like exudation. The affection is seldom attended with delirium, or other signs of cerebral disturbance; and there is a remarkable exemption from nervous symptoms of all kinds, except such as result from debility.

The patient in general loses flesh rapidly, and towards the close becomes exceedingly emaciated. Not unfrequently he is affected with diarrhœa at this stage; and the extremities, especially the feet and legs, are apt to be edematous. The hair frequently becomes very thin, and the finger-nails curve forward at the ends. With all the exhaustion and loss of flesh, the patient is often enabled to sit up much of the time until very near death. At length, however, the strength is completely worn out, and life closes, frequently without a struggle. Occasionally, the mind gives way a little before death, in consequence, probably, of excessive weakness. The duration of hectic fever is altogether indefinite, depending on the progress of the complaint producing it. Its march, however, is almost always slow. It usually terminates fatally in consequence of the incurable nature of its cause; but it not unfrequently also ends in recovery.

There has been much difference of opinion as to its cause. It is said sometimes to occur as an original disease; but this is not probable; and cases supposed to be idiopathic, have been afterwards traced to local affections. It is sometimes imitated in pure debility; but some of the features of the affection are almost always wanting. In all genuine cases, the union of general debility with some local inflammatory affection may be detected. It would seem, then, to consist of the effects of a powerful irritation, acting upon a feeble frame. But is there not something more? In the vast majority of cases, the local affection is attended with suppuration; and the supposition has been entertained, not without some show of reason, that the absorption of pus constitutes an essential part of the affection. It is asserted, however, that it sometimes results from great masses of local disease, as scirrhus, for example, in which there is no pus. It is not confined to cases of disease affecting the interior structure of organs, but may result also from chronic inflammation with suppuration of surfaces, as of the bronchia, bowels, urinary passages, and skin.

8. *Fatal Effects of Inflammation.* Inflammation may prove fatal in either of the following modes. 1. It may suspend the action of the organ in which it may be situated, and the due performance of whose function may be essential to life. 2. By deranging the condition of a particular organ, it may prevent the due action of another and vital organ, as where inflammation closes the rima glottidis, and, by thus preventing the access of air to the lungs, gives rise to fatal asphyxia. 3. When of great violence or extent, it may so concentrate the blood and vital forces in the part affected, as completely to prostrate the nervous and circulating functions, and thus produce a fatal issue by a species of syncope; as we sometimes see in cases of peritonitis and severe dysentery, in which the heart beats with exceeding feebleness, and the skin is cold almost from the commencement of the disease. 4. It may elaborate products, which, being absorbed or in some other way entering the circulation, may produce by their sedative agencies a typhoid condition and general prostration which shall end in death, as happens in inflammation of the veins when pus is carried into the general mass of the blood. 5. Death frequently results from the debility induced by long-continued or extensive suppuration, or by gangrene in the inflamed part. 6. We can readily conceive, moreover, that the constitutional excitement of inflammation, when very violent, or in a feeble constitution, may be succeeded by fatal collapse.

The appearances which inflammation leaves behind it after death will be most conveniently considered elsewhere. I will here merely state that these appearances are sometimes deceptive. It has been asserted that inflammation may prove fatal without leaving the ordinary traces; the blood deserting the vessels at the point of death, or subsequently. But this may be considered as somewhat doubtful. It is certain, however, that appearances closely resembling inflammation, so far as relates to congestion of the capillaries, or effusion of blood, are often presented in the bodies of those who have died a violent death, though previously in the full enjoyment of health; and much care is necessary not to confound such appearances with those of a real inflammatory origin.

2. *Nature of Inflammation.*

An outline having been given of the ordinary phenomena and course of inflammation, it comes next in order to treat of its nature, and to explain the various steps of the complex process. That this may be done understandingly, it is necessary to be acquainted with the results of microscopic observation; as the changes going on in the inflamed tissue are quite beyond the reach of accurate examination by the unassisted eye.

Microscopic Observations.—Among the many who have investigated this subject microscopically, may be mentioned Wilson Philip, Thomson, Hastings, Gendrin, Kaltenbrunner, and more recently Gerber, Müller, Lebert, Gulliver, Addison, C. J. B. Williams, Wharton Jones, Hughes Bennet, and Paget, as the authorities mainly depended on in the statements which follow. The experiments were generally made on the web of a frog's foot, which readily admits the passage of light; but, lest it should be objected to the phenomena thus observed that, being exhibited in a cold-blooded animal, they are not applicable to the explanation of the process as it occurs in animals with warm blood, it may be mentioned that they correspond in all essential particulars with the appearances presented by the wing of the bat, which belongs to the latter class.

When a part is irritated, either mechanically or by a stimulant substance, the minute vessels, whether arteries, veins, or capillaries, are variously affected in relation to their diameter, being sometimes diminished in size, sometimes immediately expanded, and sometimes little if at all altered for a time. If not immediately dilated upon the application of the irritant, they very soon become so; and it is not till the occurrence of dilatation that the appearances of inflammation are presented. This expansion is sometimes very considerable, amounting to twice or even thrice the ordinary diameter of the vessel. At the same time that the observable capillaries are thus dilated, others before unseen become visible, probably by the entrance of the red corpuscles into vessels before too small to receive them. The motion of the blood is much affected, along with these changes in the capacity of the vessels. At first, the current occasionally slackens, or even retrogrades for an instant; and not unfrequently oscillatory movements may be noticed; but, when the dilatation has been effected, the blood flows more rapidly, and a much greater quantity passes during a given time than in the unexcited state of the part. After a time, however, the current becomes slower, without any diminution, or even with an increase of its size; and this retardation gradually increases until at length a complete stagnation takes place in some of the vessels, while in others the circulation continues, and in some of the larger, especially in the outskirts of the inflammation, may go on with a greater velocity than in health. The blood thus stagnating is not disposed to coagulate, remaining liquid for a long time, and sometimes resuming its onward movement when circumstances favourably modify the inflammatory condition. During the slackened or stagnant state of the blood, another very interesting change takes place. In the healthy state, the red corpuscles occupy only the middle of the current, leaving a colourless space between them and the walls of the vessels, in which a white corpuscle may be seen now and then floating along. In inflammation, the red corpuscles increase in proportionate amount in the part affected, till at length they fill the whole capacity of the dilated vessels, becoming also much more crowded. It is obvious that they are detained, while the liquor sanguinis flows onward. When the blood has become quite stagnant, the outlines of the corpuscles can sometimes be no longer seen, and the vessel presents an almost uniform bright carmine hue. Another phenomenon is one before alluded to, the appearance, namely, of an increased number of white corpuscles, which seem to have an affinity for one another, and for the inner surface of the tube, along which they roll slowly, and to which many of them adhere. Whether this adhesion arises from a vital attraction, or a mere physical viscidity, has not been ascertained. In some instances, they accumulate so largely as to block up the tube, and prevent the passage of the red corpuscles, though the colourless portion of the blood may percolate through them. But this occurrence, to which attention was called by Drs. Williams and Addison, is stated by Mr. Paget not to take place in warm-blooded animals, and therefore cannot be received in explanation of the phenomena of inflammation. In those instances in which the capillaries first contract under stimulation and afterwards expand, a reapplication of the stimulant, after the dilatation of the vessel and retardation of the blood, will produce again a temporary contraction, and a more rapid current, to be again followed by dilatation. In such a case, the original action of the irritant, instead of producing immediate redness, causes the part to be even paler than before; but the subsequent dilatation is accompanied by redness, which disappears when contraction is again produced, to return once more when the vessels expand. The walls of the vascular tubes are perfectly continuous, without exhibiting the slightest natural orifice, even when most largely dilated. The liquor sanguinis exudes through invisible pores, and, being quite transparent, cannot be seen at first, unless coloured, as sometimes happens, with the red liquid of the corpuscles, which, escaping from the cellular envelopes, exudes along with it. Occasionally, the corpuscles themselves are effused into the tissue through ruptured orifices in the capillaries. In a very short time, the fibrin of the exuded liquor becomes visible through coagulation, and then exhibits numerous granules, organized spherical bodies, called *exudation corpuscles*, and a vast multitude of interlacing fibrils, which give firmness and tenacity to the coagulated mass. The corpuscles at first bear a close resemblance to those found in the chyle of the thoracic duct, and to the white corpuscles of the blood.* They undergo various changes, being converted into fibro-plastic cells, filaments, and possibly blood-vessels, when the coagulated fibrin undergoes organization, and degenerating into pus corpuscles, compound granular corpuscles, granules, &c., when it is to become quite degraded, and to be surrendered ultimately to chemical laws. Sometimes these corpuscles are alone developed in the exuded liquid, which then does not coagulate, and is wholly incapable of organization.† After a short time, when the coagulated lymph becomes organized, red lines are seen penetrating it in various directions, inosculating with one another, and finally forming a network of blood-vessels, which have a vascular connexion with those of the neighbouring tissue.

In parts softened by inflammation, as in softening of the brain, for example, the microscope renders visible numerous granules, and *compound granular corpuscles*, which are often very large, spherical, and consist of numerous cohering granules, sometimes though not generally surrounded by a vesicular envelope. Not unfrequently these corpuscles may be seen apparently in the process of disintegration, breaking up more or less completely into irregularly clustered and isolated granules. Another singular phenomenon sometimes presented, when hemorrhage accompanies the inflammation, is the presence of very large corpuscles, consisting of a transparent envelope enclosing several of the blood corpuscles, which appear to be undergoing various degradation. Several microscopic observers have noticed an irregular dilatation, or, as it were, aneurismal pouching of the capillaries and of the small arteries and veins of an inflamed part, probably owing to a weakening of the coats, occurring in the progress of the inflammation.

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* Mr. Paget gives the following account of the formation of these corpuscles: "The first discernible organic form, the form of what might with propriety be called the *primordial cytoblast*, is that of a minute mass of soft, colourless, or pale grayish-white substance, round or oval, pellucid, but appearing, as if through irregularities of its surface, dimly nebulous or wrinkled. It does not look granular, nor is it formed by an aggregation of granules; nor, in its earliest state, can any cell-wall be clearly demonstrated, or any nucleus. But, as the development of this cell-germ or cytoblast proceeds, a pellucid membrane appears to form a cell-wall over its whole surface; and now, when water is added, it appears to penetrate this membrane, raising up part of it like a clear vesicle, while upon the other part the mass retreats, or subsides, and appears more nebulous or grumous than before. In yet another state, which appears to be a later state of development, the action of water not only raises up the cell-wall, but breaks up and disperses the outer part of the contents of the cell, i.e., of the enclosed mass of the primordial cytoblast, and exposes in its interior a nucleus, which is commonly round, clearly defined, pellucid, and attached to the cell-wall."

† The discovery noticed already (see *note*, page 5) of the existence of two chemical substances in fibrin, separable from each other by chemical means, one exhibiting minute fibrils, the other granules under the microscope, is happily illustrative of the fact stated in the text. The one may give rise to the fibrils, the other to the granules and exudation corpuscles of coagulating fibrin; and, as one or the other is most abundant, will be the predominance of its particular form. Probably both are necessary to perfect organization; and hence, perhaps, the observed fact that, when the corpuscles alone occur in a liquid, no organization is effected.

The general aspect of pus has been already described, and the fact mentioned, that it consists essentially of a serous fluid, and of peculiar corpuscles floating in that fluid. There are also other bodies usually present; and, as it is sometimes important to distinguish pus from different products somewhat resembling it to the eye, its microscopic characters merit a further notice. *Pus corpuscles* are globular, and have a mean diameter of somewhat more than $\frac{1}{3000}$ of an inch, being about twice that of the blood corpuscle. They have a finely granular surface, and are somewhat diaphanous. On the addition of water they swell considerably, lose the granular appearance, and become more transparent. Acetic acid also increases their transparency, and renders visible an interior body, consisting of one or more nuclei. The number of the nuclei is usually two or three, but sometimes amounts to five. Occasionally, these corpuscles are observed to have a distinct vesicular envelope, forming cells of about $\frac{1}{1200}$ of an inch in diameter, which vary in shape according to the pressure to which they are exposed. Water and acetic acid dissolve this cell-wall, and set the contained corpuscle free. (Hughes Bennet.) Pus corpuscles, in undergoing degradation, are resolved into granules and molecules, which ultimately become fluid. Along with these bodies are often seen in pus red blood-corpuscles, unchanged exudation corpuscles, compound granular corpuscles, numerous isolated granules, fatty matter in molecules or globules, rhomboidal plates of cholesterin, and the debris of the tissues from which the pus proceeds, as cellular fibres, and epithelial or epidermic scales.

Theory of Inflammation.—Numerous theories have been formed to explain the phenomena of inflammation. The following views are those which appear to me to accord best with observation and reason. An irritant cause acts on a part of the body either immediately from without, or through the blood, or by the instrumentality of the nerves. Morbidly increased action or irritation is excited in the part, embracing probably all its vital constituents, as well the ultimate molecular or cell structure, as the blood-vessels, and nerves. According to the nature of the cause, or its precise mode of application, the irritation may commence in either of the constituents mentioned; but, when it has attained the grade of inflammation, the whole of them are always involved. The first observable change is in the capillaries and minute arteries and veins. Whether these contract at first or not, they soon increase in diameter, as the direct result of the irritant influence, and probably through an active, vital, expansive power of their own. Consequent upon this enlargement is the entrance into them of an increased quantity of blood; and the backward flow, or oscillating movement, which has been observed in them at this point of time, may be ascribed to the influence of atmospheric pressure, which tends to force the blood into the dilated portion of the vessels from both directions; but, when the enlargement is completed, the regular forces which move the blood onward gain the ascendency; and it then flows in its regular course with an accelerated movement, consequent upon the increased operation of these forces under the stimulant cause. Hitherto the action may not have exceeded the grade of irritation. But, probably through the same excitant influence of the cause, the constituents of the blood itself are stimulated to an increased exertion of their vital forces. Hence arises an augmented proportion of fibrin, and a disposition of the corpuscles somewhat to cohere through their vital attraction. The blood is thus rendered more viscid, and the red corpuscles accumulate in the expanded vessels, much beyond their normal proportion; so that the whole increased capacity of the tubes is crowded with them. Their forward movement is consequently impeded, not by any inactivity of the impelling forces, but by the mechanical obstacle opposed by these results of the higher vital action of the blood. At this stage, inflammation is fully established; and it will be observed that, according to the views here taken, it is thus far purely an excessive exercise of the vital powers of the parts concerned. This retardation of the blood at length ends in absolute stagnation in some of the vessels; but in others it is still flowing with increased rapidity, so that much more passes through the inflamed part in a given time than in health, as proved by the conclusive experiment of Mr. Lawrence.* Through the walls of the distended capillaries the liquor sanguinis exudes more or less altered in quality, and distends the areolar tissue, or escapes upon free surfaces. Of this fluid a portion greater or less consists of fibrin, which, though quite liquid and formless when exuded, nevertheless contains the germs of a vital growth. The exuded fibrin sometimes retains its liquid form for a considerable time, in other cases coagulates immediately; but always sooner or later undergoes this process when it is to become organized. Frequently, the inflammation proceeds no further than the point of effusion; when it abates, absorption of the effused liquids takes place, and the part returns unchanged to health. But if it continue, the fibrin coagulates and undergoes a series of organizing changes, all of them the result of vital action, and indicative, it appears to me, of an increased exertion of vital power. The invisible germs assume the shape of molecules, which unite in rows to form fibrils,† or around a common centre to form granules, the latter of which are ultimately developed into the exudation corpuscles. The fibrils rapidly interlace so as to create a tissue of greater or less firmness, while the corpuscles, which when fully formed are complete nucleated cells, appear to be capable of undergoing various changes according to the wants of the diseased structure. Sometimes they elongate at each extremity, and, joining end to end, form filaments, which serve as the basis of a new fibrous tissue. It is not impossible that they are also the origin of the new blood-vessels, which rapidly form in the exuded and coagulated fibrin, and thus advance its organization. Different opinions, however, have been entertained upon this point. John Hunter believed that the coagulable lymph generates its own blood-vessels, which afterwards form a connexion with the previously existing vessels; and Rokitansky and many other eminent physiologists have entertained the same conviction. One strong argument in favour of this view is the fact, that blood-vessels and the contained blood are formed, in the embryo of the chick, out of cells, without the preëxistence of other vessels. In this instance, the cell-wall shoots out in various points, forming tubes, which unite with similar elongations of other cells, so as to produce a network of capillaries; while the contents of the cells are converted into blood. Now such a change does not seem improbable in the exudation corpuscles of the recently coagulated fibrin. They are supposed by many to be identical in character with the proper chyle and lymph corpuscles. These are believed, in the ordinary process of sanguification, to be converted into blood corpuscles, probably by the developement of their contained nucleus, while their other parts may contribute to other portions of the blood. It would seem reasonable to conclude that the exudation corpuscles, arrayed side by side, might by means of their cell-wall form continuous capillary tubes, while their nucleus should be matured into the blood corpuscle, and their other contents into the liquor sanguinis. But it must be acknowledged that this is pure speculation, as microscopists have not been able to detect the steps of such a process. Hence, many maintain that the new tissue is supplied with blood by offshoots from the neighbouring vessels. Lebert and Paget are among those who take this view. But their opinions equally want the support of observation; for such offshoots have never been demonstrated; and the aneurismal pouching of the vessels, occasionally noticed in irritated parts under the microscope, instead of affording strength to the opinion, are in fact rather opposed to it; as, if the supposed offshoots really existed, they might be as readily detected as these partial dilatations themselves. It seems to me, therefore, that the fibrin is capable of self-organization, even to the production of its own blood and vessels, when duly supplied with vital influence from the surrounding tissue, which is on all hands admitted to be essential. That lymphatics exist in newly-formed parts has been proved by Schröder Van der Kolk (*Ranking's Abstract*, xii. 267), and Virschow has also detected nerves in them (*Lond. Med. Gaz.*, Aug. 1851, p. 331); but the exact source of these structures has not been proved. The inflammatory condition is here considered as lasting throughout the organizing process, and as essential to it; being in fact only such a moderate elevation of the vital actions as is necessary to carry on this excess of growth. But, if immoderate, it lessens or destroys the powers of the part by an excitation beyond its vital capacity; and, under such circumstances, instead of new organization, we have degradation or destruction.

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* In a patient with inflammation of one of his hands, Mr. Lawrence made similar openings in the veins of both arms, and found that three times as much blood flowed in a given time from that of the side affected, as from the other.

† See observations of M. Mouneret in the *Archives Générales*, 4e sér., xxx. 112.

It sometimes happens, from the quantity of coagulable lymph thrown out, from its defective quality, or from its position in relation to living tissues, that, instead of becoming the seat of a series of vital changes, it merely dries up, assuming a firm, hard, sometimes almost horny consistence, without any appearance of organization or vitality. But much more generally, when the vital influences are insufficient to carry through the changes in the lymph requisite for its conversion into organized structure, the result is the production of pus, or the process of suppuration. This may ensue from a defective quality of the lymph exuded, depending on a depraved state of the blood; from the exhaustion of the vital forces of the affected tissue, consequent on excess or long continuance of the inflammatory excitement of the part affected, and possibly of the blood itself; from such a position of the exuded lymph that it is excluded from the influence of neighbouring living tissues; or from whatever else has the effect of lowering the vital powers concerned in the process of organization. From such causes, the exudation corpuscles, unable to advance, lose their vitality, and pass into the condition of pus corpuscles, which are capable of no other change than one of degradation. At the same time, the other ingredients of the exuded matter, if coagulated, are liquefied, and converted either into the serous constituent or isolated granules of pus, or possibly into the compound granular corpuscles sometimes found in that product; though it is most probable that these latter bodies, as well as the distinct granules, proceed directly from the disintegration of exudation corpuscles. Should the pus not escape from the body, it may undergo further degradation; the corpuscles being resolved into granules, and these ultimately assuming the liquid form, so as to admit of being absorbed; and thus nature provides for the elimination of this product, which is a necessary result of her efforts at repair, when foiled in the organization of the exuded lymph. The tendency of the exuded matter of inflammation to pass into pus, is directly proportionate to the quantity of exudation corpuscles contained in it, and inversely to that of the fibrillating material; so that, when most disposed to coagulation it is least to suppuration, and vice versa.

Another mode of degradation, dependent on the same deficiency of vital force, is the softening and destruction of tissue in the processes of suppuration and ulceration, and in those other cases in which legitimate pus is not among the products. This appears to be effected, in part at least, by the resolution of the decaying tissues into compound granular corpuscles or isolated granules, and the ultimate liquefaction of these products, so that they may be absorbed when not eliminated with the pus.

Still another mode of degradation is the change of the exuded lymph, and perhaps in some measure of the debilitated tissues, into fatty matter, of which more will be said under the head of depression, as it is a not unfrequent result of that pathological condition, altogether independently of any preceding inflammation. Instead of fat, calcareous matter sometimes takes the place of the normal constituents of the degenerating exudation corpuscles; and not unfrequently the two are mixed together; and we have coincident fatty and calcareous degeneration. In other instances pigment granules are produced in greater or less abundance in the corpuscles.

The death of portions more or less extensive of the exhausted tissues is the lowest point of their degradation.

In all these cases, if life continue, an effort of repair is made in those parts of the structure which have vital energy enough remaining for the purpose; and this effort consists in a continuance of inflammation, or its establishment in new parts. Thus, when an abscess has been formed by the destruction of portions of the inflamed tissue, or when an ulcer has resulted from the same cause, the parts around take on such a moderate degree of inflammation as is necessary for the exudation of organizable lymph. The same is the case where an ulcer has arisen from the sloughing of a mortified part. The exuded fibrinous matter closes the blood-vessels, and consolidates the areolar tissue, so as to prevent hemorrhage, and the diffusion of the pus and other degenerated products. It does more. It forms granulations by its organization, and thus fills up the cavities. These granulations are found, when examined by the microscope, to consist of a network of vessels, in the interstices of which are fibrils and exudation corpuscles. The same process is, in fact, going on in them as in the coagulable lymph undergoing organization in other situations. The outer layer of corpuscles, not having the vital influence of the tissues exerted sufficiently upon them, degenerate, and are converted into pus corpuscles; and hence granulating surfaces are usually covered with pus. After the cavity of the abscess or ulcer has been filled to the level of the surface, the granulations cease to grow, and become covered with an epidermis on the outer surface, and an epithelium on the mucous surfaces, in consequence probably of the conversion of the exudation corpuscles into epidermic or epithelial cells.

Whether this process of organization takes place in lymph exuded into the interstices of tissues, or in that extravasated in the course of granulation, in either case, after the growth has ceased, absorption of the liquids present, and of portions of the solid tissue formed takes place, which goes on till the structure is brought to the condition in which it is ultimately to remain; and this absorption is accompanied with considerable contraction.

The newly formed parts sometimes bear a more or less close resemblance to those of the vicinity, being fibrous, ligamentous, adipose, bony, or epidermic, according as they are intended to supply the place of one or the other of these tissues. Whether this result is owing to something peculiar in the character of the coagulable lymph exuded in each vicinity, or whether to some influence exerted on it by the neighbouring tissue after exudation, has not been determined. But there are some structures which are never exactly replaced, as the skin, muscle, &c. Dr. Addison gives a beautiful explanation of this result. No tissue can be produced except from peculiar germs. The blood or its fibrin is furnished with the germs of its own substance as well as of its containing tissue, and of analogous structures. The fibrin may be developed into areolar, fibrous, ligamentous, and vascular structure, and even into blood, because it contains the germs of these, everywhere so essential. But the more elaborate tissues have germs of their own, which are merely developed by the blood serving as a nutriment to them, and not made out of the blood. Hence, they cannot be produced from fibrin alone. (*Lond. Med. Gaz.*, Aug. and Sept. 1850, pp. 193, 316, 488.) The new formed parts, like the old, are liable to irritation, inflammation, and various morbid degeneration or deposition, as the fatty, calcareous, melanotic, tuberculous, cancerous, &c.

The views above given of the inflammatory process are those entertained by the author. In relation to the increased action of the blood-vessels, and the excessive exercise of the vital properties generally of the part affected, they are in accordance with the opinion suggested by Van Helmont and Stahl, adopted by Haller, Cullen, Hunter, and Bichat, and still maintained by many distinguished pathologists. But an opposite theory, which maintains that the vessels are in a state of debility, and traces most of the phenomena of inflammation to this source, was put forth by Vacca at Florence so early as 1765, and was afterwards advocated by several pathologists, especially by Mr. Allen of Edinburgh, in his lectures; though it did not attract general attention till adopted and supported by Wilson Philip, whose microscopic observations appeared to give it countenance.

The doctrine of debility of the capillaries maintains that, in every case of inflammation, these vessels, weakened either directly or indirectly by the cause of the affection, become relaxed, and yield to the distending force with which the blood is sent into them by the heart, or the arterial trunks from which they proceed. They are thus dilated, admit a larger quantity of blood, and give rise to the red colour which characterizes the onset of the inflammation. According to Wilson Philip, at the same time that the capillaries are debilitated, the arteries by which they are supplied are stimulated to increased action, so that the disproportion between the resistance and power is still further augmented. The blood necessarily moves more slowly through the distended vessels; and thus the retardation of the current in the capillaries, visible by the microscope, and the increased action of the arterial trunks leading to the inflamed part, which is obvious to the naked eye, are equally accounted for. The advocates of this doctrine, admitting contractility as the only active vital property of the blood-vessels, maintain that it is impossible to explain the phenomena of inflammation upon the principle of increased capillary action. The only mode, they assert, in which the capillaries can evince increased action is by increased contraction; and this, so far from causing a slower flow of blood and increased redness, must necessarily produce the opposite results of a more rapid current and greater paleness. These, they say, are the conditions actually exhibited under the microscope, upon the application of certain stimulants. The expansion of the vessels which follows, and which is the first step of inflammation, results from the debility or relaxation consequent upon the exhaustion of their excitability by the previous stimulation. When dilatation of the vessels immediately follows the application of the cause, it is to be ascribed to the immediately debilitating influence of the cause; for the existence of a vital expansive property is altogether denied by the advocates of this hypothesis.

It appears to the author that this theory of inflammation, however ingenious, fails altogether to account for the retrogression of the blood which is observed, with the aid of the microscope, in parts irritated and reddened. Were the expansion merely an effect of the pressure from behind, operating upon a diminished resistance, the increased capacity should be filled by the forward current of the blood, and not by a retrograde movement in the vessels beyond. Besides, if the dilatation be a result of debility or relaxation of the vessels, the greater the debility the greater should be the dilatation, and a loss of all vital power of resistance in the capillaries should be attended with the greatest possible amount of distension. But the reverse is the fact. When, by the operation of some powerful cause, the capillaries of a part of the body lose all or nearly all their vital power, instead of dilatation and consequent redness, we have paleness and a diminished supply of blood, which with difficulty penetrates the vessels. Such, for example, is the result of a violent blow paralyzing for the moment the vessels of the part. It is true that reaction may subsequently come on, and symptoms of inflammation make their appearance; but, in this case, the vital powers arise by their temporary suspension into increased energy, and the vessels cease to be in a state of debility at the moment when they begin to expand. Yet another difficulty in the way of this hypothesis is the direct occurrence of expansion upon the application of certain irritants, as of common salt in the experiments of Thomson, and of the point of a needle in those of Gendrin. Why one irritant should produce direct debility of the vessel, while another produces the same state indirectly, through the medium of a previous excitation, the theory does not satisfactorily explain.

It has been stated that the author is inclined to the opinion which considers inflammation as the direct result of an increased vital action in the part affected. I shall proceed to state the grounds upon which this opinion is based, and some of the arguments which may be adduced in its support. In the first place, the theory of increased action requires the admission of a power of action in the capillaries, to a certain degree independent of the heart. The existence of such a power is denied by some; but the arguments adduced in its favour appear to the author incontrovertible. This is not, however, the proper place for the discussion of that question, which belongs to works on physiology, to which the reader is referred. (See also *Thompson on Inflammation.*)

The nature of the causes from which inflammation results would appear to indicate its active character. These are almost always such as, if applied in a moderate degree, produce merely a healthy excitation of the part, or an exaltation of its ordinary functions, and give rise to inflammation only when the increased action has proceeded so far as to occasion obvious organic derangement. We see various degrees of excitation, in proportion to the amount of the cause applied, from the slightest increase of the healthy function up to inflammation; nor is it possible to say where, in the ascending scale, merely healthy excitation ends in irritation, or this in inflammation. Why should we suppose that, in this regular ascent, the nature of the action changes at once when evidences of its inflammatory character are presented?

The following facts may be considered as evidences of the active character of inflammation. The artery supplying the inflamed part beats with greater force, and, if divided, sends out the blood to a greater distance than in health. Although in some of the capillaries the circulation is retarded or even suspended, yet the whole quantity of blood entering and leaving the inflamed part in a given time is increased. The ordinary phenomena presented in the early stages of inflammation are those which would be expected from an increased exertion of the vital power. Thus, we have increased heat, which can hardly be ascribed exclusively to the blood accumulated in the part in consequence of the expansion of the vessels; as there is reason to believe that the temperature exceeds that of the blood before its arrival, especially in parts distant from the centre of circulation. It must, therefore, result from a more energetic exercise of that vital function which generates or evolves animal heat. The increased secretion which attends the earliest stage of inflammation, the new products which are copiously eliminated in the more advanced stage, the exalted sensibility of the part affected, and the rapid generation of new structure, are all results which seem to imply either an elevated condition, or more vigorous exercise of the vital properties. The influence of topical remedies of a sedative character, such as cold, the preparations of lead, and warm water, in relieving inflammation, affords further evidence to the same effect.

The sudden expansion of the capillaries in inflammation has been considered one of the greatest obstacles in the way of the theory of increased action. It is asserted that these vessels have no other active property than contractility, that it is only by yielding to pressure that they can be expanded, and that their dilatation therefore is a proof of their debility or relaxation, or at least of a diminution of their power of resistance compared with the force applied to them. But there is no proof that the capillaries are not possessed of an active power of dilatation. The assertion that they have no such power is pure assumption. Its existence rests on the same evidence as that of vital contractility. Two stimulants are applied, of which one is followed immediately by contraction, the other by dilatation of the capillaries. We have as much right to assume that the latter is active as the former. We have been too much in the habit of considering visible contraction as the result exclusively of muscular action. The existence of a muscular coat has not been proved in the capillaries, and there is no necessity to assume its existence. We can as easily conceive that, under a certain modification of nervous influence, the succession of particles which may be considered as constituting a circular ring of a capillary tube, may approach each other so as to produce contraction, as if this were effected by a muscular fibre; and there is no greater difficulty in conceiving that, under a different modification of the same influence, the particles may repel or recede from each other, and thus produce dilatation. The nervous influence has been considered as strongly analogous to the galvanic. Now there would be no great difficulty in so arranging a circle of minute objects, as to cause them to approach or recede from each other, in other words to produce a contraction or dilatation of the circle, by a varied electrical current. The same result may take place in the living capillary, under a diversity of nervous influence, brought into play by diversity in the circumstances of irritation. In both cases, in that of dilatation as well as that of contraction, the phenomena would be equally the result of a vital property called into action. There is no impossibility, therefore, in the existence of a vital active power of expansion.

Admitting the existence of such a power, we shall find it very convenient in the explanation of various phenomena, physiological, as well as pathological, which cannot otherwise be well accounted for. Blushing; determination of blood to the head under the influence of certain mental emotions; the sudden expansion of the erectile tissues under local or mental excitement; the sanguineous congestion of organs which have become the seat of a new or renewed vital action, as of the uterus in gestation, and the mammæ in lactation; the analogous congestion of parts called into an increased exercise of their habitual function, as of the stomach during digestion, of the muscles during energetic contraction, of the secretory organs in inordinate secretion, and of any part whatever during rapid and unusual growth; these and other phenomena, in which an accumulation of blood in the capillaries is exhibited, at the same time that these vessels are stimulated to a more energetic performance of their proper office, would seem to imply that the dilatation, by which alone the congestion can be effected, is of an active character. The cause of the congestion cannot exist in the heart or larger trunks; for an increased action of these organs would be felt equally in all parts of the body, and very often they remain perfectly tranquil during the occurrence of the local phenomena mentioned. The operation is entirely local. The cause of excitement is applied; the capillaries dilate; and the blood rushes into them in increased quantity under the influence of atmospheric pressure. Hence the flow of blood to any part or organ which is excited by a stimulant to a more rapid or energetic performance of its office. Hence the retrograde movement of the current in the capillaries, and the general direction of the blood for a moment towards the centre of irritation, and the seat of expansion, as observed by aid of the microscope. Hence, consequently, the congestion which is always the first observable change, in that series of changes which constitutes the process of inflammation. That the capillaries should sometimes contract, as shown by the microscope, upon the application of a stimulant, is not adverse to the opinion here advocated; for contractility and dilatability are both considered as active properties, and both may therefore be roused into operation by a stimulant, though we do not understand what are the precise circumstances which give a direction of the excitement rather to the one than to the other property. We only know that, whenever the irritation amounts to inflammation, the expansibility is called into action. The reader who may wish to prosecute this inquiry further, will find the arguments in support of the doctrine of an active dilatability of the capillaries, very fully stated in a paper by Dr. H. L. Hodge, in the *N. Am. Med. and Surg. Journ.*, vol. vi. p. 1. The chief difficulty in the way of the theory of capillary excitement is the fact of the retardation and stagnation of the blood in several of the vessels. If the part is in a state of excessive action, how should it happen that certain vessels should cease to act altogether? This difficulty is removed by the result of recent researches. The rapid increase of fibrin, rendering the blood more viscid, and the acquired disposition of the red corpuscles to crowd together, both of them probably the effect of an increased exertion of vital power, will account for the retardation and even stagnation of the blood. Of the same tendency is the discovery of the fact, that the white corpuscles also crowd together, and adhere to the sides of the vessel and to each other; but, as this phenomenon has not been noticed in hot-blooded animals, it cannot be used as an argument in the present case. The increased production of fibrin, however, is one of the strongest proofs that could be adduced of an increased exertion of vital power. Hence, in cases of low or feeble inflammation, in which, though vital action may be increased, the powers of the part are inadequate to the development of the requisite amount of vitalized fibrin for exudation, the want of this preservative principle leads to the most destructive results. Pus, or other wholly disorganized matters, take the place of coagulable lymph; no boundary is set to the diffusion of these products; and the resulting injuries are inadequately repaired, from the insufficiency in quantity or quality of the great reparative agent.

Various other theories of inflammation have been broached at different times. Not to mention the vague notions entertained before the circulation of the blood was discovered, the theory of Boerhaave, which had for a long time great vogue, deserves a brief notice. By this celebrated author, inflammation was believed to depend upon obstruction of the capillaries, produced either by an unusual viscidity of the blood, or by the entrance of red globules into vessels not intended for their reception, and too small for their passage. To this latter circumstance he applied the name of *error loci*. The characteristic phenomena of inflammation were ascribed by him to the accumulation of blood behind the point of obstruction. The error of Boerhaave was in considering, as the cause of inflammation, what is merely, when it occurs, one of its effects or attendant circumstances. The doctrine of obstruction has recently been strenuously advocated by Magendie, who asserts that artificial inflammation is simply a mechanical result, arising from obstruction of the capillaries, and consequent distension of the neighbouring vessels. In the present state of our knowledge, however, no explanation is likely to be generally received which leaves out of view the vital properties of the part affected. Authors who admit the existence of an increased action in the inflamed part, differ in relation to the precise nature of that action. Cullen imagined the existence of spasm in the extreme arteries, supporting an increased action in the course of them, and thus giving rise to the phenomena of inflammation. But it need scarcely be observed that his opinion upon this point was quite conjectural; as the existence of such a spasm is altogether insusceptible of proof. The opinions of Hunter were very nearly those which have been advocated in this work. He believed that there was an increased action in the vessels, and at the same time an increased distention. According to Hunter, however, inflammation is to be regarded as a salutary process, intended to restore parts which have suffered from violence or disease to their healthy state. This is undoubtedly true in many cases; but can scarcely be predicated of inflammation in general, which is often itself the direct result of the morbid cause, without any violence to the part, and without any discoverable intermediate disease. Dr. Allison has advanced opinions in relation to inflammation which are somewhat peculiar. He admits that the vital properties of the inflamed part are concerned, and that there is to a certain extent an increase of the vital actions; but, not believing in the active dilatability of the capillaries, he is led to the supposition, in order to account for the accumulation of blood, that there is a vital attraction between this fluid and the surrounding textures, which is increased in inflammation, and thus causes an increased flow to the part affected. This may possibly be the case; but such an attraction has never been demonstrated; and it appears to the author that sound induction would scarcely justify the assumption of its existence, in order to explain phenomena which are quite as easily explicable upon the principle, that the universally admitted expansibility of the vessels is an active, and not merely a passive property.

3. *Causes of Inflammation.*

As inflammation is the last step in the advance of excitement, being that condition in which irritation, as defined in this work, if increased beyond a certain point, necessarily terminates, it follows that its causes must be essentially the same as those of irritation, only greater in degree, or longer continued. The reader is, therefore, referred to the remarks upon irritation for a general account of these causes. Anything peculiar in their mode of action, or their direction, will be most appropriately considered under the heads of the various special diseases they produce. It is sufficient here to observe that among these causes there is this distinction, that, while some in their action often stop short at irritation, if applied only for a short time or in a slight degree, others necessarily result in inflammation. Thus, substances which wound, or corrode, or in any other way produce a solution of continuity, often necessarily give rise to inflammation; since this is a process essential to the restoration of the injured part. The presence of extraneous bodies within the organs, in like manner, occasions inflammation, which is requisite for their discharge by means of ulcerative absorption, or, if they should be retained, surrounds them with an organized cyst, which prevents their irritant influence on the neighbouring parts. In the light of extraneous substances may be regarded certain morbid secretions or depositions within the organs, which require the intervention of the inflammatory process for their elimination, and dead portions of the body itself, which can be separated and replaced only by a similar instrumentality. Some irritant causes, though their morbid action may not necessarily result in inflammation, are more apt to produce it than others; such as alternations of temperature, and various morbific poisons.

Certain conditions of system strongly predispose to inflammation; so that causes which, under other circumstances, would stop short at irritation, in these, are apt to occasion the higher grade of disorder. Richness of the blood, or superabundance of the red corpuscles, of albumen, and of fibrin, no doubt has this effect, and is probably capable itself of producing inflammation, without the co-operation of other causes. The febrile movement operates powerfully in favouring the same result, and often, indeed, acts not only as a predisposing, but as a direct cause.

4. *Modifications of Inflammation by Tissue.*

No view of inflammation can be complete, which does not embrace an account of the modifications produced in it by the tissue in which it may occur. It is, however, only general notices that are required in this place; as the description of particular cases of inflammation, occupying particular structures, will necessarily embrace the details. Our attention will also be confined here to that form of inflammation which occurs in individuals without peculiar morbid predispositions, and is not induced by causes calculated to give it a peculiar character. The influence of tissue is felt, not only in the character of the inflammation in the part affected, but also in the sympathetic disturbance of other parts, or of the system generally; and it will be treated of, in each case, in relation to these two points. For much of what follows, it is proper that I should acknowledge my indebtedness to the work of Gendrin.

1. *Areolar or Cellular, and Adipose Tissues.*—These tissues are considered under one head, as their only observable difference is in the circumstance that the latter secretes a fatty matter, which is deposited in its cells. Inflammation of the ordinary character, occurring in these tissues near the surface of the body, is usually called *phlegmon;* and, as it is considered the type of this form of disease, it has been customary to distinguish common inflammation, wherever it may exist, by the title of *phlegmonous.* The successive changes attending inflammation of the cellular tissue have been sufficiently described under the general head. Though quite insensible in health, this structure is often very painful when inflamed, and especially so when the part affected is confined by a fascia, or tendinous expansion. The character of the pain is usually aching rather than sharp, and becomes pulsative when suppuration takes place. It is burning only when there is something peculiar in the affection, as in erysipelas and carbuncle, and, under these circumstances, indicates a tendency to gangrene. There is decided redness and much swelling, and the inflammation is very apt to proceed to suppuration. It not unfrequently leaves induration behind it, especially in its chronic form.

As the areolar tissue is not exposed to the direct action of external irritants, and lies almost without the ordinary circle of sympathies, it is less apt to be originally affected than most other tissues, and, when inflamed, is so, in most instances, in consequence of the propagation of inflammation from some contiguous structure, as from the skin and mucous membranes. From the same deficiency in sympathetic connexion, it produces, when inflamed, less disturbance in other parts, or in the system at large, than the serous or mucous tissues, and is less readily reached by remedies acting through the constitution. Thomson states that the fever usually attending inflammation of the cellular tissue is of an asthenic character; but he probably refers rather to certain peculiar affections, such as anthrax or erysipelas phlegmonodes, than to phlegmon itself, which, when it gives rise to fever, is generally attended with sufficiently vigorous action.

2. *Serous Tissue.*—Next to the skin and mucous membranes, this is perhaps most frequently inflamed. The areolar tissue, however, which connects the serous membranes with the organs or structure which they line or invest, always participates in the inflammation, and, according to Gendrin, is in fact usually its original seat. The inflammation may be confined to the serous and subjacent cellular tissues, or may also extend into the contiguous structure, especially when it is of a somewhat analogous nature, as in the case of pleurisy extending into the lungs.

An inflamed serous membrane exhibits, at first, numerous red points or streaks, in separate patches, which ultimately coalesce. Sometimes, however, instead of being reddened, the membrane, as in the instance of the arachnoid, merely loses its polish, and presents a milky appearance; and, in other cases, this appearance is observable in the intervals between the red points. The subjacent cellular tissue becomes infiltrated with serum, and causes the membrane itself to appear thickened. Losing also its tenacity, it allows the membrane to be more readily detached from the parts beneath, so that shreds may be separated after death.

The serous exhalation often increases and accumulates in the cavity of the membrane; but, when the inflammation is fully established, the surface usually becomes dry in the part specially affected, though from other portions which are merely irritated the exhalation may continue. The serous fluid is often reddened with blood, and sometimes unaltered blood is effused. Very frequently, after a short time, the inflamed membrane exudes a glutinous substance, which is sometimes disposed in layers, sometimes in distinct granules, or a kind of network, and agglutinates the opposite serous surfaces, or, if these are movable, is drawn out into connecting strings or filaments. This substance consists of fibrin, with a mixture of albuminous liquid. It gradually becomes denser and more adherent, while the serous fluid, which was at first limpid, assumes a turbid appearance, and contains floating flakes of a whitish or yellowish colour, and of the same character with that adherent to the surface. The latter is now penetrated with blood, becomes vascular and organized, and is converted into that morbid structure denominated *false membrane*. This process sometimes begins so early as twenty-four hours after the appearance of the exudation, sometimes much later, and sometimes does not occur for months.

When the inflammation is so violent as to prove speedily fatal, no false membrane is found, but a bright redness, with small ecchymoses, and a little reddish-yellow serum.

Sometimes the subserous tissue is infiltrated with pus, and pus or a puriform liquid is found in the cavity. This is apt to be the case when the inflammation continues long, or an exacerbation comes on in its advanced stage, without immediately destroying life.

When the inflammation subsides, the effused liquid is absorbed, and the false membrane, before of a red colour, gradually becomes paler, and at length takes on the appearance and character of cellular tissue. Permanent adhesions are thus frequently formed between opposite serous substances, especially in the pleura and peritoneum.

In *chronic* inflammation, the redness is less vivid than in the acute, and is sometimes wanting. There are greater thickening and density, in consequence partly of changes in the subserous tissue, partly of the incorporation of the false membrane with the original structure. The serous membrane is more tenacious, but at the same time more difficult to be detached, because the cellular tissue is also more tenacious. The surface is often rough and of a dull appearance, and is sometimes studded with small whitish granules, perceptible to the touch, but scarcely elevated, which have been mistaken for tubercles, but differ in being inseparable from the surface of the membrane, never encysted, and never softened. (*Gendrin.*) The fluid in the cavity is often limpid, sometimes gelatinous, sometimes purulent, but generally yellowish-white or milky, with portions of coagulated matter floating in it. Though usually distended with liquid, the cavity is sometimes filled with a sort of cellular tissue resulting from organized false membrane, which is infiltrated with pus, and occasionally itself forms cavities, in which pus is collected and confined. When a cure takes place, the liquor is absorbed, the cavity contracts, and the new tissues become firm, and sometimes of a fibrous consistence. Often, however, the false membrane is entirely absent, especially in those cases in which the inflammation has been of a chronic character from the outset. The effused fluid occasionally remains after the cessation of the inflammation, constituting a kind of dropsy, but distinguishable from the genuine forms of that disease by the evidences of previous inflammation, presented in the thickened and altered tissue. The serous membrane and subjacent cellular structure remain for a long time dense and indurated, and, as well as the false membrane, become sometimes as hard as scirrhus, or assume even a cartilaginous or bony character.

Ulceration seldom occurs in ordinary inflammation of the serous tissue. Sometimes, however, it does take place in old cases, consequent upon the pressure of the accumulated fluid, which thus finds an exit. It may arise also from gangrene, though this is rare.

Though insensible in the healthy state, the serous tissue becomes in general exceedingly painful when inflamed. The pain is acute, and much increased by motion or pressure. The sharp character and severity of the pain serve, in some measure, to distinguish inflammation of this tissue from that of the parenchymatous or mucous tissue in its neighbourhood. Sometimes, however, pain is almost or quite wanting, as in certain cases of pleurisy and pericarditis; and errors in diagnosis have not unfrequently originated from this cause.

Serous inflammation is usually attended with a sthenic condition of the system, which bears and requires copious depletion. As a general rule, it is less apt than that of some other tissues to call distant organs into active sympathy; and occasionally it is known to exist to a considerable extent, without any other disturbance than pain and increased action of the heart, and even these are sometimes wanting.

Inflammation of the *synovial membranes* is very closely analogous to that of the serous; but it occurs less frequently, and is less apt to be attended with effusion of coagulable lymph, and consequent adhesions. When adhesion takes place in joints, it arises, for the most part, from ulceration and granulation. Except as the result of injury, or of rheumatism or gout, inflammation of the synovial membranes is generally chronic, and frequently associated with the scrofulous diathesis. When acute, especially if traumatic, it is often very painful and severe, involving the safety of the patient, and requiring active treatment.

3. *Fibrous, Fibro-Cartilaginous, and Cartilaginous Tissues.*—The *fibrous tissue*, including the periosteum, dura mater, aponeuroses, capsular ligaments, tendons, &c., is sometimes affected with inflammation, though much more frequently with the rheumatic and gouty than the ordinary form of that affection. The changes which it undergoes are those described under the general head. It becomes red and swollen, loses its fibrous texture and tenacity, so that it may be torn in any direction, and contracts adhesions to neighbouring parts, which participate in the inflammation. Acute inflammation of this tissue seldom eventuates in suppuration or gangrene. It affords, indeed, strong resistance to mortification when existing in its vicinity; and tendons have sometimes been found in a sound state in the midst of a slough. In *chronic* inflammation, the tissue is often much thickened, and undergoes an imperfect suppuration. When very long inflamed, it often loses entirely its original character, and becomes cartilaginous or bony. Sometimes ossification and suppuration are going on together.

The fibrous tissue is insensible in health, but often very painful when inflamed; and the constitutional symptoms are sometimes very violent.

The *fibro-cartilages*, a structure intermediate between the fibrous and proper cartilaginous tissues, of which we have examples in the intervertebral and interarticular cartilages, the annular ligament of the radius, and the cornea, are occasionally affected with inflammation, being much softened, reddened, and infiltrated with a turbid reddish fluid, which becomes sero-purulent, and is sometimes collected in small abscesses in its substance. Inflammation of this tissue, however, is little known, and is not often original.

Cartilages are but little exposed to inflammation, and, being without blood-vessels, are insusceptible of the process as ordinarily observed. Yet, when wounded, they may heal by the formation of tissue out of their intercellular substance or the nuclei of their cells, and are affected sometimes by a kind of ulceration, consisting in a degradation of their structure, and its absorption or elimination. (Redfern, *Month. Journ. of Med. Sci.*, Sept., 1851.) Hence, the cartilages which form the articulating surfaces in movable joints sometimes disappear during long-continued inflammation of the neighbouring bony structure. Others, such as those of the larynx, trachea, and ribs, throw off portions from their surface, or exfoliate when the perichondrium is inflamed. According to Gendrin, these are occasionally affected with a chronic inflammation, which begins in the perichondrium, and gradually modifies the cartilaginous structure, so as to make it approach to the fibrous. They are thus apt to ulcerate, and sometimes assume a bony character. They occasion little pain or constitutional disturbance; and that which does occur, is probably ascribable more to the accompanying inflammation of the neighbouring parts than to that of the cartilages themselves.

4. *Cutaneous Tissue.*—From the complex nature of this tissue, its numerous sympathies, and its peculiar exposure to the direct action of morbid causes, it is liable to a vast variety of inflammatory affections, differing in the particular portion of the structure which they occupy, in their greater or less degree of violence, and in their nature. These diversities, being obvious to superficial observation, have been accurately traced, and are recognized for the most part as special diseases, requiring separate description. I shall here treat only of ordinary inflammation of the skin, as, for example, that produced by Spanish flies, or other direct irritant.

It often happens that the surface only is affected, the inflammation not extending beyond the reticular layer beneath the cuticle. Under these circumstances, there is generally a slight swelling, with a redness which disappears upon pressure, and returns upon its removal. If the inflammation be very slight, or subside speedily, the cuticle usually separates either in furfuraceous scales, or in larger portions, and the skin is left shining, and of a purplish or somewhat violet redness. If it be severer, or of longer duration, a serous fluid is secreted, appearing under the cuticle in small separate collections, which soon run together and form a blister, and the surface at the same time generally becomes paler. The fluid is yellowish and somewhat viscid, sometimes acid, sometimes of a gelatinous appearance, and, if the inflammation persist, becomes at first reddish, then turbid, and ultimately purulent. It abounds with exudation corpuscles, and is therefore specially disposed to the formation of pus. It appears to me probable that these so-called exudation corpuscles are nothing but young undeveloped epidermic cells, which become degraded into pus corpuscles because deprived of those conditions essential to their complete developement. Occasionally, when the inflammation is very active, a whitish or yellowish-white layer of matter resembling coagulable lymph is produced beneath the cuticle, forming a kind of false membrane, which, however, is not organisable. The same appearance is often presented upon the surface deprived of its cuticle, and irritated by some stimulating substance, as savine or mezereon. Small quantities of exudation on the surface, whether of lymph or puriform, often dry up and form scabs.

After death, in slight cases of brief duration, the appearances of inflammation are entirely lost; but, if the inflammation has persisted for forty-eight hours, the skin is apt to offer a somewhat violet colour, and the cuticle separates sooner than in the inflamed parts, upon the commencement of decomposition. In severe cases, even though lasting not more than a day, the corium appears injected, and somewhat thicker than in health; and the affected part putrefies more readily than the rest of the skin.

Inflammation may extend from the surface of the true skin, through its substance, to the subjacent cellular membrane. This is known, during life, by the sensation of hardness imparted to the finger, and by the redness not disappearing under pressure; after death, by the redness, want of tenacity, and occasional bloody infiltration of the skin. (*Gendrin.*)

The corium may be the original seat of inflammation, which also frequently attacks especially or exclusively the sebaceous follicles.

Ulceration is a frequent occurrence in the suppurating surface of the skin; and gangrene is probably more common in this than in any other tissue, unless it may be the areolar.

It has been said that inflammation is very much disposed to travel when it occurs in the skin. But this is true only of that variety denominated erysipelatous. Common inflammation does not usually extend so rapidly in the skin as in some other tissues, particularly the serous membranes and absorbents. Witness the effects of blisters and sinapisms, which are generally confined to the limits of the original application on the skin; while the inflammation often rapidly runs up the absorbents to the nearest gland.

The pain is apt to be burning, and, in the milder cases, is often of an itching, tingling, or pricking character. The attending fever is seldom so energetic as that which marks inflammation of the serous tissue, and is not unfrequently decidedly asthenic. Cutaneous inflammation is not often dangerous, unless it involve a very large extent of surface. It is frequently, however, an attendant upon other diseases, which are highly dangerous, in consequence, not of the affection of the skin, but of disorder in one or more of the interior organs; and in these diseases it sometimes proves advantageous by diverting irritation from more vital parts. It is a curious fact that diseases attended with some variety of cutaneous inflammation are very often of a contagious nature, and, upon their disappearance, leave the system insusceptible to a second attack. The number of strictly contagious diseases is few, which are not habitually accompanied with inflammation of the skin, in some form or another, at some period of their course.

5. *Mucous Tissue.*—This is perhaps more frequently inflamed than any other tissue, partly from its direct exposure to irritating causes, partly from its delicacy of structure, and the wide range of its sympathies. As in the case of the skin, different constituent portions of its structure may be affected, and great diversity may arise also from the state of health or constitution of the patient, or the nature of the cause. Whatever is specific will be reserved for future consideration.

In inflammation of the mucous tissue, as it ordinarily occurs, there is redness, varying in intensity from a light pink or rose colour to a reddish-brown, sometimes punctuated or ramified and quite superficial, sometimes in patches, and occupying the whole thickness of the membrane. The tint is usually somewhat purplish, deepening with the advance of the disease, and becoming at length almost violet. The redness is generally most intense in the centre of the inflammation, gradually becoming paler as it recedes from this point; but, sometimes, especially in the alimentary mucous membrane, it is nearly uniform throughout, and marked by abrupt and well-defined limits. The membrane is somewhat rough upon the surface, especially when papillary, and is more or less thickened. When rough, with minute prominences, it is said to be *mamillated*. It may be easily separated from the parts beneath, in consequence of the loss of cohesion in the subjacent cellular tissue. Sometimes the membrane itself is softened, so that it breaks under the forceps when attempts are made to raise it; and there may be every degree of this softening, from a slight fragility up to perfect diffluence.

In delicate membranes, a bloody serum infiltrates the sub-mucous tissue; in thicker membranes, the same effusion takes place in the mucous tissue itself. In the advanced stages of the inflammation, the place of the serum is occupied by a purulent infiltration. In some cases, there is a very strong tendency to serous effusion, so as to produce an edematous condition, which, in certain positions, as in the neighbourhood of the glottis, is productive of no inconsiderable danger. This is particularly apt to happen in patients with dropsical tendencies. In such cases, there is less redness than is ordinarily observable in others.

The inflamed membrane is at first drier than in health, and rapidly absorbs fluids in contact with it; but the secretion soon increases in quantity, and is at the same time altered, losing in great measure its viscidity, and becoming serous, limpid, and sometimes acrid. As the inflammation advances, it becomes less copious, but more viscid and opaque, assuming a whitish or yellowish-white appearance. At the greatest height of the inflammation, the secretion is almost suspended; but is afterwards reestablished, and at this time is frequently tinged with blood. If the disease persist, it often gradually assumes a purulent character, becomes more abundant, and at length takes on the appearance of pure pus; and this change is coeval with the purulent infiltration of the membrane itself. When examined by the microscope, the discharge is found to consist of an amorphous fluid, which is the proper mucous secretion, and of epithelial scales, granules, and corpuscles of various size and character, with which are not unfrequently mixed proper blood-cells and shreds of fibrillated lymph. The corpuscles are chiefly young epithelial cells in different stages of developement, or pus corpuscles, which are sometimes very abundant. The former are frequently called mucous corpuscles.

In the earlier stage of inflammation, the mucous fluid is thrown off more copiously; at first transparent and thin, but gradually becoming thicker, whitish, and opaque, from the admixture of increasing quantities of the effete epithelial cells, and of the yet incompletely developed cells, which the excess of action causes to be separated before maturity, and perhaps to be generated more abundantly than in health out of the lymph exuded through the basement membrane. When the vital powers begin to be exhausted, these corpuscles degenerate into those of pus, probably in part through the formation of oil; and it is by the accumulation of the latter bodies that the secretion assumes gradually more and more of the yellow purulent character, until it sometimes at length becomes almost pure pus. Not unfrequently black pigment granules are found in considerable quantities in the degenerated mucous corpuscles, especially in affections of the bronchial mucous membrane. By the character of the epithelial scales mixed with the mucous secretion in inflammation, the exact seat of the affection may sometimes be determined; as the form of these cells varies in different parts of the membrane.

It has been asserted that inflammation of the mucous membrane might exist, without leaving observable traces after death: but it could neither be severe, nor long continued; as the effusion and stasis of blood would in either of these cases reveal it. Gendrin states, as the result of his observations and experiments, that redness of the membrane, when beyond the point of mere vascular arborisation, does not disappear at the point of death.

Pseudo-membranous or Plastic Inflammation.—Inflammation of the mucous membranes is sometimes attended with a secretion of albumino-fibrinous matter, which concretes, and forms false membranes on the surface. This is not so much dependent on the intensity of the disease as on the condition of the blood, or some peculiarity in the constitution of the patient; for it appears in every grade of inflammation, from the slightest to the most severe. It is most common in children. Inflammation with such a tendency is called *pseudo-membranous* or *plastic inflammation*. It is not unfrequent in the air passages, and sometimes occurs in the alimentary canal. The membrane, in relation to its texture, is in the same condition as in ordinary cases; but the redness is not so deep, and there is less swelling. The coagulated matter, which is whitish or yellowish-white, and rather dense, appears at first in points or patches, which spread, and at length coalesce, so as often to form complete tubes within the living ones. It has been supposed by some to be capable of becoming organized; but Gendrin has never seen traces of vessels in the false membranes which it forms, and Andral considers the apparent vessels, which have been observed communicating between them and the proper membrane, as mere prolongations of the coagulated matter, dipping down into the mucous follicles. Sometimes these false membranes are gradually thinned till they become like a delicate epidermis; sometimes they are softened and converted into a kind of thick mucus, or puriform matter; and sometimes they are separated from the mucous tissue by a layer of mucus or of pus beneath them, and are rejected either whole or in fragments. Occasionally, other parts of the same membrane upon which they are formed afford an abundant mucous or muco-purulent secretion.

Follicular Inflammation.—Inflammation of a mucous membrane may affect chiefly or exclusively the glandular follicles, producing small, rounded, prominent, more or less pointed tumours, when the distinct follicles are inflamed; or flattish and somewhat depressed tumours, consisting of aggregated follicles, with which, in the alimentary canal, the inflamed villi are also mingled, forming patches of some extent. But, without attention, a healthy erection of these mucous glands may be mistaken for inflammation. In the state of normal excitement, they are diaphanous, with a little depression marking the orifice of the duct; in inflammation, opaque and reddish, with a phlogosed condition of the adjacent portions of membrane; and, as the inflammation advances, they lose entirely the follicular character, becoming merely small phlegmons, and often ulcerating.

Chronic Inflammation.—In *chronic inflammation*, while the disease is at its height, there is usually a dark redness; but, in very old cases, or where the affection is slight, there is little discoloration, and sometimes none. The membrane is rough upon the surface, somewhat harder to the touch than in health, thicker, denser, more cohesive, and capable of resisting maceration for a longer time. The follicles are often observable in an enlarged and indurated state; but in old cases they are apt to be confounded with the altered tissue. The mucous secretion is more copious than in health, more viscid, of a grayish or yellowish-gray colour, and composed frequently of proper mucus and pus, which, upon being thrown into water, separate into two portions, one thick and ropy and floating on the surface, the other without cohesion and falling to the bottom. In cases in which the inflammation is considerable, there is often also much serous exhalation.

In very slight and old cases, there is only left a thickening of the membrane, with a slight vascular injection, and follicles more voluminous than in health. Such cases are known, during life, only by increased mucous or muco-purulent secretion, and are not always easily recognized after death. The most evident characters are infiltration of the subjacent cellular tissue, a slightly granular appearance of the surface, and a somewhat altered colour, which, if normally white, is now whitish-yellow with reddish streaks, or, if rose-coloured in health, is of a darker and more livid hue. After the cure of chronic inflammation, the vessels often remain enlarged and injected, presenting red ramifications in the substance or on the surface of the membrane, dividing till they are no longer perceptible, and appearing unconnected with any trunk; which last character distinguishes these injections from those of passive congestions.

When acute supervenes upon chronic inflammation, the diseased tissue becomes again red and infiltrated, as well as the cellular tissue beneath, with blood or bloody serum. This effusion is soon succeeded by pus, and the membrane loses its tenacity, becomes *friable* or *softened*, and, in the case of the alimentary mucous membrane, is sometimes *quite disorganized, and reduced to a pulpy or semi-liquid state.* Sometimes, instead of this change, small red excrescences form in the membrane, which at length become gray, dense, and hardened, and remain after the inflammation has ceased. (*Gendrin.*)

Though, contrary to formerly received opinion, there may be copious suppuration from mucous membrane, without the slightest trace of ulceration, yet there is perhaps no tissue so liable to the ulcerative process as this. If inflammation has persisted for a considerable length of time, it is rare, upon post-mortem examination, to find ulceration wanting. (*Roche* and *Sanson.*) It often occurs in original acute inflammation, but much more commonly when this supervenes upon chronic, and is frequent also in the chronic form. Gendrin states that the character of the inflammation may, in some measure, be determined by the appearance of the ulcer after death. If the edges are somewhat prominent, rough, injected with blood, and covered, as well as the bottom, with a muco-purulent layer, it may be inferred that the inflammation was acute. Hard, unequal, reverted edges, separated from the base, with roughness and a more or less livid redness of the bottom of the ulcer, indicate chronic inflammation. If the tissue around and at the bottom of the ulcer is softened, puffed up, and bleeding, there is reason to believe that acute has supervened upon chronic inflammation. Ulcers of the mucous membrane often heal with great facility. The commencement of cicatrization is marked by the edges being flattened, pliable, as it were puckered, extending towards the centre, and covered with a muco-purulent secretion. Ulcers often penetrate quite through the substance of the mucous membrane into the tissue beneath, and occasionally open a passage through the side of the tube lined by the membrane, and allow its contents to escape into the neighbouring cavity, with fatal effects. This latter event, however, is not common; as coagulable lymph is usually thrown out, and forms adhesions which prevent such effusion. Mucous membrane is also liable to gangrene, from the causes which produce this result in other tissues.

The sensation which attends inflammation of the mucous tissue varies much with the part affected. At the extremities of the passages lined by the membrane it is often acutely painful, while it is generally more dull in the intermediate portions; and it occasionally happens that the sensation produced by inflammation in the course of the passage is felt chiefly, if not exclusively, at the termination. Thus, irritation of the stomach is sometimes evinced by itching or other uneasiness in the nostrils; bronchial inflammation, by uneasiness in the throat; and inflammation of the lining membrane of the bladder, by pain at the end of the penis. Generally speaking, the pain is less severe than in inflammation of the cellular, serous, or fibrous tissue. It is usually obtuse rather than acute, and is often scarcely felt, unless on motion or pressure. Not unfrequently it is altogether wanting. In acute inflammation, there is generally a considerable feeling of heat, which is often also experienced in the chronic form.

Inflammation of the mucous tissues is often attended with sympathetic disturbance. When it occupies a portion of the membrane in which some excretory duct opens, an irritation is frequently extended to the gland from which the duct proceeds, either increasing and altering the secretion, or diminishing if not arresting it, and sometimes ending in inflammation of the gland. Hence the disordered hepatic function, so common in inflammation of the duodenum. Every grade of fever accompanies mucous inflammation, from the most vigorous to the lowest and most malignant. As a general rule, in ordinary states of the constitution, and where the disease has not originated from a peculiar cause, the fever may be considered, in relation to the grade of action, as intermediate between that of serous and that of cutaneous inflammation, supporting and requiring more depletion than the latter, and less than the former.

6. *Glandular Tissue.*—When moderately inflamed, this tissue is redder, more dense, more elastic, and less friable than in health. The lobules become more distinct, the interlobular cellular tissue being infiltrated with serum, and much less dense and cohesive than that proper to the gland. The capillaries and excretory ducts of the inflamed part are engorged with blood, and after death are quite impermeable by injections. In cases of intense inflammation, the whole texture of the gland, both the strictly glandular and the interlobular, is more injected, of a deeper or darker red, and much more brittle. The secretion, in the earlier stages, is increased in quantity, and altered in quality, approaching nearer to the nature of serum, and sometimes tinged with blood. As the inflammation advances, the secretion diminishes, so as to be less than in health, becomes acrid and even bloody, and at the height of the disease is suppressed in the most inflamed part, though it may still be maintained by other portions of the gland.

Suppuration, which does not take place with great facility, usually appears first in the interlobular cellular tissue, and afterwards, if the inflammation is intense, in the glandular also, which then becomes of a grayish-white colour, softens, and at length breaks down and dissolves in the pus. With this fluid is mingled a portion of the proper secretion of the gland, proceeding from parts bordering upon the inflammation, which are only irritated, and the excretory ducts of which are opened by the disorganizing process. Sometimes pus is discharged by the excretory duct of the gland, proceeding either from the inflamed lining membrane of the ducts, or brought by them from the purulent collection with which they may communicate. Generally, however, if the patient is not first exhausted, it makes its way by means of the combined ulcerative and adhesive processes, as before described, either through the adjacent structures externally, or into some neighbouring cavity, which also has an outlet.

When acute glandular inflammation becomes *chronic*, the redness is diminished, the interlobular cellular tissue is rendered dense, and the blood-vessels, even the trunks without the gland, remain dilated. The tumefaction is less in the slowly advancing chronic inflammation than in that which succeeds the acute. (*Gendrin.*) If the disease proceed to suppuration, this is apt to occur in the cellular tissue, which is softened and absorbed, while the enlarged glandular granules become more distinct, and as it were dissected. But the proper tissue of the gland is itself also sometimes destroyed by suppuration, the granules or lobules being no longer distinguishable. Instead of being softened and suppurating, the gland occasionally becomes indurated, under chronic inflammation. Sometimes gangrene occurs; but this is rare.

In general, the pain from inflamed glandular tissue is obtuse, and thus, in some instances, serves as a means of diagnosis between inflammation of the substance of the gland, and that of its investing serous coat. The direct influence exerted upon other organs, or upon the system at large, is not equal to that proceeding from various other tissues, and does not correspond with the importance of the gland in the economy. Great destruction of the glandular structure, even in some of the most important of these organs, occasionally takes place, without being evinced by any very obvious or considerable disturbance of the constitution. The symptomatic fever is usually of a lower grade than that which attends inflammation of the serous or mucous tissues.

In relation to the *vascular*, *muscular*, *osseous*, and *nervous tissues*, no general observations are requisite, as inflammation of each of these tissues constitutes one or a few special diseases, in treating of which, anything of a general nature that could be said here would be necessarily repeated.

5. *Specific Inflammation.*

There are numerous forms of diseased action which present the essential characters of inflammation, and yet differ in some respects so materially from that affection in its ordinary form, as deservedly to be considered distinct in their nature. As these differ as much among themselves as they do from ordinary inflammation, they may with propriety be denominated specific. It is not easy always to determine, whether this specific character exists in the essential nature of the inflammatory action, or depends upon some modification impressed upon it by another coexistent disease. It is possible that, in some cases, one of these conditions may prevail, and in others, the other. Thus, the scrofulous appears to differ from other forms of chronic inflammation chiefly by the presence of tuberculous matter, or a curdy, cheese-like secretion, which owes its existence to a peculiar predisposition, and may either precede the inflammatory action and be the cause of its developement, or may result from the disturbance produced by the inflammation itself in peculiar constitutions. So also with the inflammation attending cancer, which appears to owe its peculiarity to the developement of a new structure, in the midst of the healthy tissues. In syphilis, on the contrary, there is no observable morbid action or product distinct from the inflammatory, to the presence of which, in each particular part, the inflammation of that part can be ascribed; and yet both its course and results prove it to be a specific affection. In the former case, the peculiarity seems to depend upon foreign admixture, in the latter, to be inherent in the inflammatory action.

The specific character probably always has its origin in one of two circumstances, either in peculiarity of predisposition, congenital or induced, as in scrofula, rheumatism, gout, &c., or in the character of the exciting cause, as in syphilis, smallpox, and other contagious diseases.

As it will be necessary, in treating of special diseases, to describe each of the specific inflammations under a separate head, it is unnecessary here to do more than to allude to their existence. The most prominent of them are the *scrofulous*, the *erysipelatous*, the *rheumatic*, the *gouty*, the various *exanthematous inflammations*, as those of smallpox, measles, scarlatina, &c., the *syphilitic* and *gonorrhœal*, and all other inflammatory effects of peculiar poisons, whether of animal, vegetable, or mineral origin.

Article III.

DEPRESSION.

1. NATURE—SUBDIVISIONS, &c.—There are three conditions in which the system is below the ordinary standard of health, and which, though if slight and of very brief duration they would scarcely be accounted morbid, are decidedly so when considerable or protracted. These three conditions are often confounded under the name of debility, or asthenia, but are essentially distinct, and sometimes require different if not opposite modes of treatment. It is, therefore, important to have clear conceptions of their nature, and to be able practically to distinguish them. The conditions alluded to are depression, debility, and diminished excitability. It must be borne in mind that action, the power to act, and the susceptibility to the influence of excitant agents, which is here denominated excitability, are different conditions or qualities of the system, and may each be reduced without a necessary reduction of the others. A morbid diminution of action is *depression*, a similar diminution of power is *debility*, and the term *diminished excitability* explains itself.

These conditions may and often do coexist; but a few remarks will show that they are distinct, and may exist separately. Thus, depression or diminished action may result from a temporary abstraction of some wonted stimulus, or the direct restraining influence of some depressing agent, and yet the real power and excitability may be unimpaired. You may restrain a strong horse with cords, but you do not, therefore, necessarily lessen his strength. Loosen the cords, and it will be found that all his energy remains. Thus, remove from the system, or a part of the system, the depressing agency, and, if it has not been long applied, the unimpaired strength will be evinced by action at least as energetic as that of health. The excitability, so far from being necessarily diminished, is often increased by causes producing temporary depression; as is proved by the reaction which immediately follows the withdrawal of the depressing cause, and which is ascribable only to an augmented susceptibility, by which the ordinary healthy excitants produce more than their usual effect.

That power may be diminished, without a diminution of excitability, or of action, is no less true. It is notorious that a debilitated system is often thrown into tumultuous disorder by causes which would produce no such effect in health. Thus, in an individual much reduced by an impoverished diet, or by depletion, how often do we observe a panting respiration, and an almost convulsive action of the heart, under a degree of bodily exertion which would have scarcely discomposed these functions, in the ordinary state of the system! How often, under similar circumstances, do the slightest causes produce great nervous disturbance, amounting in the female to violent hysteria! These results can be accounted for only by admitting an increased excitability, which enables the same amount of excitant influence to produce a greater amount of effect.

Again, diminished excitability may exist without essentially involving the existence of debility or depression. When a debilitated, but unduly excitable heart, is strengthened by suitable measures, it loses its excess of excitability as it acquires vigour; yet, by an increased application of stimulant means, it may be made to act as tumultuously as it did in its more excitable state, under a less amount of stimulation. Here then is diminished excitability, with increase of strength, and without diminution of action.

It follows from what has been said that the degree of depression is by no means a certain measure of diminished strength or excitability. Yet this is often overlooked in practice, and patients with undiminished powers of system, and with perhaps an increased fund of excitability, are, in consequence of some temporary depression of the actions of health, treated with stimulant measures, to their very great detriment; and, conversely, persons greatly debilitated, but with excessive action of some important organ, dependent upon increased excitability, are no less injuriously depleted with a view to the reduction of the excitement. There is no distinction more important to the young practitioner than that which I have here attempted to draw.

Depression, like irritation, may be general or partial, affecting the whole system or a part. It seldom, however, happens that all the functions are simultaneously depressed, for any considerable length of time. Universal temporary depression is not uncommon; as in syncope, the collapse of low forms of disease, the prostration sometimes accompanying the cold stage of febrile affections, and that which often results from violent injury. Instances of its longer continuance we have in the state of system which sometimes follows acute diseases of excitement, and in the gradual failure of old age, though the latter may perhaps be justly considered as one of the phases of health. But, as a general rule, even when the whole system is debilitated, the depression itself is partial, or even mingled with undue excitement; one or more of the minor systems or organs being more or less irritated, while the remainder are depressed.

In cases of partial depression, some particular region or organ may be affected, as a limb, a gland, a muscle, &c.; or some system of parts, as the circulatory, absorbent, secretory, or nervous.

Again, the depression may be merely functional, without observable organic change, even to the loss of life; or it may be attended with derangement of the organization, as in some cases of softening, in fatty degeneration, and in gangrene.

As irritation may be either a simple increase, or an alteration with increase of the vital actions, so depression may be a mere reduction of these actions, the function being performed in the same manner, but less vigorously than in health, or may be attended with peculiar phenomena, differing entirely from the normal, and entitling the affection to the name of specific. Thus, the depression consequent upon the loss of blood is entirely different from that which attends malignant fevers. The instances of specific depression will be treated of in connexion with the special diseases in which they occur.

2. CAUSES OF DEPRESSION.—Depression is either *direct*, dependent on the abstraction of the ordinary stimulus essential to healthy action, or on the operation of positively sedative agents; or it is *indirect*, resulting from the operation of certain laws of the system, which determine this condition as a consequence of other antecedent conditions in the same or different parts of the body. The causes of depression may, therefore, be considered under the two corresponding heads of direct and indirect.

a. Direct negative Causes.—As the vital actions all depend upon the operation of certain excitants upon the susceptibilities of the system, it follows that, upon the diminution or removal of these excitants, the action must be diminished or cease. Among the most common and efficient causes of depression are those which consist in such a diminution or removal. These will be first considered.

Reduction of the quantity or quality of the blood.—The natural stimulus, within the system, essential to all its movements, is the blood. A due quantity and quality of this fluid are necessary to the support of the vital actions in their normal state. It would, therefore, be rationally inferred that a loss of blood, or such a change in its constitution as may render it less stimulating, must, in the healthy state, be followed by depression. This result may flow from a direct loss of blood, whether spontaneous or artificial; from the loss of a portion of its constituents through excessive secretion; or from a diminished production, or altered quality in that produced, arising from deficiency in the quantity or quality of the food, or insufficiency in the processes of digestion, chylification, &c., by which the food is converted into blood. Hemorrhages, blood-letting, colliquative sweats, diarrhœa, diabetes, the operation of evacuant medicines, a restricted or exclusively vegetable diet, indigestion and mesenteric disease interfering with the formation of chyle, should, therefore, all operate as causes of depression. It is possible, moreover, that certain substances introduced into the system may, by a chemical influence on the blood, so far deteriorate its character as to disqualify it for its proper offices; though it would be difficult to point out any one substance, of which this could be said to be proved. It is, however, certain that, in some diseases, as in malignant fevers, for example, the blood does undergo great deterioration, either from the direct action of the poison introduced, or from derangement of the organs, and thus becomes wholly unfit to support the healthy actions, which are consequently greatly depressed. In all these cases, there may not only be depression of action, but there is also reduction of power or positive debility, which necessarily ensues when the organs are insufficiently supplied with that pabulum out of which they were formed, and on which they continue to depend for their existence.

But it must be borne in mind that a mere loss of blood, or a mere diminution of its stimulant properties, without any positively noxious deterioration, though it may cause debility, does not necessarily diminish excitability. On the contrary, the organs feel more acutely the impression of other excitants, and are stimulated into excessive action by causes which would not have this effect in health. I have before alluded to the tumultuous disorder produced, under these circumstances, in the respiratory and circulatory systems, by moderate muscular exertion, and in the nervous system by slight causes of disturbance. Even without any apparent increase of excitant agency, the heart very often acts with greatly increased frequency. This phenomenon, however, may be explained. The nutrition, muscular contraction, digestion, and other functions constantly going on in the system, require a certain amount of blood for their support; and, in order to insure the requisite supply, nature has established such a sympathy between the parts in which these functions are performed and the heart, as to call the latter organ into increased action, when any deficiency is experienced. If all the functions are reduced in proportion to the reduction in the character or quantity of the blood, there will be no undue action of the heart. But if these functions are to be sustained in their usual state, if the individual eat as much, exercise as much, or perform other ordinary acts as much as usual, then the supply of blood, under the ordinary impulse, is insufficient for the purpose, and the heart is compelled, by increased effort, to send a more rapid current, to make up for the deficiency in the dimensions of this current, or its quality.

Again, it appears to be an established law, that an inverse relation of activity exists between the absorbent and circulatory functions, so that when the latter is depressed the former is elevated, and *vice versa*. The reason for this is, obviously, that any loss from the blood-vessels may be supplied by a more energetic absorption; the cause, probably, either a diminution of pressure within the blood-vessels, so that fluids may more readily enter, or a reverse sympathy between the organs performing the two functions, or both combined.

It has already been observed that the nervous system acquires the same increased excitability, and is often brought into great disorder by comparatively slight causes. Hence, mental disturbance, wakefulness, restlessness, irregular muscular contraction, neuralgia, &c., are not unfrequent attendants upon a state of debility arising from depletion, abstinence, and other causes, that lessen the mass, or deteriorate the quality of the blood. As the nervous centres are the media through which the wants of the functions make themselves felt, and through which the requisite influence is sent to the sympathizing organ, it is easily understood why they are themselves disturbed in cases in which the functions are insufficiently supported.

From what has been stated, it will be inferred that a state of universal and constant depression is by no means the necessary consequence of the set of causes which we are now considering; that, on the contrary, absorption is generally promoted, and various other functions occasionally much excited; and that, in order that the functions may be brought into a steady condition of depression, corresponding with the diminished quantity or quality of the blood, it is necessary that the ordinary amount of excitant agency to which these functions are exposed should be diminished in the same ratio. Hence, in cases of debility from hemorrhage and similar causes, a uniform depression of the vital actions in general is not to be looked for, unless the amount or quality of food, the amount of muscular effort, and the exercise or gratification of the senses, passions, and moral faculties, be kept within or below the ordinary limits.

But the irritation produced in systems debilitated and yet excitable is not more uniform than the depression. The two conditions are apt to alternate, or one function may be depressed while another is elevated, according to the nature and direction of the exciting causes. If these causes continue to operate, and the debility be not repaired, the excitability is also at length exhausted, and the patient sinks; or, what is perhaps more common, some fatal organic disease is brought on by the disturbance of the organs; or, finally, the patient falls a victim to some accidental complaint, which a more vigorous state of his system might have enabled him to resist or surmount.

In relation to the effects of deficiency of food, either as to quantity or quality, it remains to be added to the observations already made, that there are limits beyond which this cause, instead of producing a depression of the vital actions, gives rise occasionally to high irritation, amounting sometimes to delirium or insanity. This may arise from the reaction of the sensation of hunger upon the organs, or from the character of the blood, which, deriving its supplies exclusively from the absorption of the materials composing the body, is probably more irritating than in its healthy state.

In relation to the action of evacuant medicines, it may be stated that most of them, while they reduce the quantity of the blood, act also as local irritants; and the irritation produced in one spot may sympathetically reach others; so that the debility which must to a certain degree result, is attended with a mixture of depression and excitation, varying according to the precise nature of the cause.

Cold, or abstraction of heat.—A certain amount of heat being necessary to the living system, not only to preserve its constituent parts in the due physical state for the performance of their several offices, but also as one of the stimulants which support the vital actions, it follows that cold, which is nothing more than the diminution of heat, should be succeeded by a direct reduction of these actions. And such is the fact. The first impression of cold is to diminish sensibility, circulation, secretion, and every other function in the part immediately affected. It is true that pain is experienced from severe cold; but this is by no means necessarily an evidence of increased nervous action. It is, in fact, a frequent attendant upon a depressed condition of the nerves; and in this case is associated with a marked diminution of the special sensibility. Every one knows that the fingers, when aching with cold, are wholly incapable of exercising duly the sense of touch. It is true, also, that there is contraction of the capillaries in the chilled part. Hence the goose-flesh appearance of the skin exposed to cold. But this does not arise from a stimulation applied to the contractility of the capillaries. It probably results, in part, from the physical law which determines expansion and contraction, as the consequences respectively of increase and diminution of temperature, and, in part, from the loss or diminution of that function in the capillaries, by which the circulation of blood in these vessels is effected, and which is evinced, as I have before attempted to show, to a certain extent, in active dilatation. All the immediate effects, then, of cold, are those of depression.

But this agent differs materially from that last mentioned in not diminishing, unless long or intensely applied, the power of the part. Heat is not, like the blood, necessary both as a material for nutrition and a stimulant to action. It is only in the latter of these two capacities that it is required, and consequently its partial withdrawal is followed only by a diminution of action, and not by a loss of power. Nor does moderate cold lessen the excitability, but rather increases it, probably by the short rest which it yields to this property by the diminution of its stimulus. It follows, therefore, that the reduction of action by moderate cold is temporary. Even during the continuance of the cold, the power being unimpaired and the excitability increased, an augmented action ensues, usually designated as *reaction*, which, by producing in the part an increased evolution of heat, obviates the continued operation of the original cause; and this reaction, unlike that which often follows the application of excitants in real debility, is of a healthy and invigorating character, unless, indeed, it amount, as often happens, when the primary depression was considerable, to inflammation. Cold, therefore, though an immediately depressing agent, is secondarily corroborant, and is frequently applied for this purpose very effectively.

The remarks made of the local effects of cold are true also of its general operation upon the system; this operation being directly sedative or depressing, and indirectly tonic or excitant. Strictly speaking, however, it is not possible for a moderate degree of cold to act directly upon the whole system; as, before it can reach the interior portions of the body, it excites a reaction, which obviates its immediate effects. The remark, therefore, must be taken in the more limited sense of an extensive, rather than a universal operation.

But, though moderate cold, both locally and generally, often ultimately augments the vital actions, yet, if increased and continued, it is capable of entirely overcoming the tendency to reaction, and of producing a steady depression, which may end in the death of the body, or a part. In either case, the whole of the vital actions gradually diminish until they cease altogether.

It has been stated that, under the temporary influence of cold, the vital power is not reduced along with the vital actions. Of course, where these actions are altogether arrested, life, which is sustained by them, ceases, and the vital power ceases with it. This is not contradictory to the statement alluded to. But the continued operation of a considerable degree of cold does produce debility; the nutritive function, upon which the support of due strength depends, being thus impaired. This is especially the case when the cold is united with an impoverished diet. In the reaction which generally succeeds exposure to cold, the increased exercise of the functions produces an increased expenditure of blood, which can only be sustained by a sufficient supply of aliment. The additional heat, therefore, which accompanies this reaction, and counteracts the external cold, is derived ultimately from the food. If this be deficient, the reaction and its attendant increase of calorification cannot be sustained; and the system is left unprotected to the depressing influence of the cold. Hence the state of debility into which persons in the lowest stations of life are apt to fall, during winter, under the combined influence of cold and bad living, and which, in such individuals, is apt to end in the production of low forms of fever, or to induce the typhous state in diseases having another origin.

b. Direct positive Causes.—The causes hitherto mentioned have been of a negative character, consisting in the diminution of some wonted stimulus. There are others which act directly and positively. Among these is *warm water*. The depressing effects of this agent are obvious in the local relaxation produced by warm fomentations or poultices, and the general relaxation, amounting sometimes to fainting, which results from the use of the warm bath. Similar relaxation, attended with nausea, is well known to succeed the use of warm water as a drink. The mode in which this cause operates will be explained under the general head of the *causes of disease*.

Warm water appears not only to diminish action, but to impair both the power and excitability of the part on which it acts. Hence we do not observe that reaction following its application, which is so apt to follow the application of cold. On this account, it is often much preferable as a remedial agent. It may be said not to be universally depressing, as it often greatly promotes perspiration, whether taken internally or applied to the skin. But perspiration is often the result of pure relaxation and debility of the skin; the serous fluid passing through the vessels, because they have not sufficient energy to resist it. Such is probably the case when it arises from the application of warm water, except, indeed, so far as the water may be absorbed, and act upon the secretory function by the stimulus of distension.

Numerous *poisons* act as depressing agents by a direct sedative power. Such are the contagion of typhus fever, the effluvium from congregated persons in unventilated rooms, hydro-sulphuric acid, hydrocyanic acid, digitalis, tobacco, the preparations of lead, &c.

To the same division belong the *depressing* passions, such as grief and fear, the influence of which is often fatally felt at periods of public calamity, either in greater tendency to low forms of disease, or in greater susceptibility to any prevailing epidemic. Some of the excitant passions also occasionally produce appearances of depression; as when, in a fit of violent anger, the face becomes pale instead of being flushed, as it usually is, and the pulse feeble instead of being excited. But these appearances are probably owing to a concentration of action in the brain, withdrawing it from other parts, on the principle of revulsion, or crippling that organ in such a degree that it is unable to transmit the influence necessary for the due action of the other organs.

To the direct causes of depression belong also violent injuries done to any particular part, as by a severe blow, suspending immediately its functions, without any previous excitement. Here it is obvious that the action only, and not the powers of the part are depressed, unless, indeed, the violence has been sufficient to destroy its life; for, except in the latter case, reaction always follows the temporary depression, and generally ends in inflammation, often of a very high grade.

c. *Indirect Causes.*—It is a well established law of the animal economy, that undue action is followed by subsequent depression. The excitability is diminished by a too energetic exercise, and will not for a time respond to the ordinary amount of stimulus. A temporary diminution of action is, therefore, a necessary result. In cases of violent excitement, the subsequent depression is proportionably great, sometimes even to the destruction of life; as where severe inflammation is succeeded by gangrene, and the stimulant operation of a poisonous quantity of opium, by fatal prostration. But, if this danger be avoided, the excitability is gradually recruited by rest, and health is after a time restored. If, however, previously to this return to the normal state, the organ or system be again stimulated; as a greater amount of stimulation is requisite, so is the exhaustion of excitability, and the consequent depression greater. By a continued repetition of this course, great prostration is occasionally induced; and the diminished action is here attended with a diminution both of power and excitability. Examples of this kind we have in systems worn out by repeated and long-continued excesses.

Excitement in one part produces depression in another, upon the principle of revulsion, as already explained under the head of irritation. Thus, depression, or a want of due action in the stomach, not unfrequently results from undue excitement of the brain, as in severe and continued study; and nothing is more common than deficient action in the extremities, in cases of a morbid excitement of some central organ.

Disease, whether of excitement or depression, existing in a particular system or organ, and interfering with the proper performance of its functions, very often produces depression in the dependent functions. Thus, pressure upon the brain, or organic changes in its structure, are frequent causes of paralysis. Cases of depression from this cause are almost innumerable. Death, in fact, is in most instances only the last stage of depression in the vital actions, consequent upon disease in some one or more organs, whose integrity is necessary to the sustenance of these actions. It is obvious, however, that it is, in general, not the depression, but the local disease which requires treatment; and, as this is often inflammatory, serious mistakes are sometimes made by stimulating for the apparent prostration, when depletion is required for the removal of its cause. We may rank in this category those cases of severe and occasionally fatal prostration, which result from a shock upon the nervous system, so powerful as to suspend or materially interfere with its functions. Such is the prostration sometimes produced by concussion of the brain, by sudden and startling intelligence, by very severe surgical operations, &c.

It is highly probable that the sympathy between our different organs is extended, as well to states of depression, as to those of excitement or irritation.

This is denied by some, and M. Begin maintains that it is impossible for a debilitated organ to transmit, by sympathy, a similar condition to any other organ. His opinion seems to be grounded upon the idea, that each sympathetic impression is necessarily the result of action in the impressing organ. But this is not essential. Sympathy between separate parts is such a connexion as enables one part to share in any impression made upon another, of whatever nature the impression may be; and it is as easy to conceive that a depressing agency may propagate its influence in this way, as one of excitement. We know that cold, applied externally, often arrests internal hemorrhages; as when cold water is applied to the head in epistaxis, to the armpits in hæmoptysis, and over the pubes in uterine hemorrhage. In all these instances, the vessels of the internal mucous membrane participate in the depressing effect of the cold upon the cutaneous capillaries. It is not difficult to explain theoretically the sympathetic propagation of depression. The deficiency of action in a part may, through the afferent nerves, cause a partial vacuum in the nervous centre, which through the efferent nerves may occasion a similar deficiency in the sympathizing organ; the nervous power obeying the same law as that which governs analogous electrical movements.

3. PHENOMENA, EFFECTS, &C., OF DEPRESSION.—In every case of depression, there is a diminution of activity in the function of the part, organ, or system affected. If the whole system is affected, all the functions are depressed. This seldom happens unless for a short period before death, or during some sudden collapse, as in syncope. It is wholly unnecessary to detail the symptoms of depression, so far as they are obviously a mere diminution of the phenomena of health. To say that sensation, muscular motion, and intellectual action are impaired, that digestion is less vigorous in all its departments, that absorption goes on more slowly, that the heart beats less frequently and more feebly, that secretion and nutrition are diminished, and that less animal heat is evolved, is merely to express the fact of the depression of these various functions. But phenomena frequently occur, which are strictly the results of depression, and yet so closely resemble those of super-excitation or irritation, that they may be and often are confounded with them, to the great detriment of the patient. These, therefore, it is important to distinguish; and, in reference to them, I shall survey the several functions, touching upon such points, in each, as may seem to deserve notice in a general treatise.

Depression in the *nervous centres*, though marked, in its extremes, by want of sensation and muscular motion, and a general failure in all the dependent vital actions, is frequently attended with irregular muscular movements of a convulsive or spasmodic character, which might readily be mistaken for the effects of irritation. Such movements we sometimes see as the result of bleeding carried nearly or quite to syncope, and of the administration of sedative poisons, as hydrocyanic acid, which generally gives rise to convulsions in the midst of the greatest prostration, and almost at the point of death. How spasm should result from the two opposite conditions of nervous irritation and depression, we cannot certainly explain, without a more intimate knowledge of the nature of nervous action. It is not difficult to give a hypothetical explanation. Allowing the nervous power to be analogous in its action to galvanism, we have only to suppose that a diminished supply is, in consequence of a depressed condition of the nervous centre, transmitted to the alternate particles of an ultimate muscular fibre, which, being thus brought into a negative state in relation to the neighbouring particles of the same fibre, would necessarily approach them and thus produce contraction; while the same result would follow a similar disturbance in the natural equilibrium of the fibre by the transmission of an excessive supply, in consequence of nervous irritation, to the same, or to the remaining set of particles. This, it is true, is mere speculation; but it is sufficient to show that there is no necessary contradiction in the ascription of spasmodic muscular action to the two opposite causes mentioned; and the fact appears to be too well established to admit of reasonable denial. It is important in a therapeutical point of view; as it may often save us a vain search after some point of irritation which does not exist, and prevent the application of depressing remedies, when the morbid affection is itself the direct result of depression. But spasm is not the only disturbance consequent upon diminished nervous action, which might be mistaken for the effect of excitement. Restlessness, obstinate wakefulness, excessive pain and other deranged sensations in infinite variety, irregular perception, and an unsettled state of intellect amounting to delirium, may all result from positive nervous depression.

In treating of dyspepsia, I shall hereafter have occasion to show that various phenomena are the immediate consequences of a depression of the *digestive function*, which might easily be confounded with the effects of irritation or even inflammation of the organs concerned.

The function of *absorption* is not so obvious to examination as to afford the means of detecting accurately the nature of its irregularities. It is a well established fact, that the amount and rapidity of absorption are, to a certain degree, inversely proportionate to the fulness of the blood-vessels, and the rapidity of the circulation; so that the process is often most vigorous in a state of general debility and depression. But it is difficult to determine whether this result arises from a positive invigoration of the absorbent apparatus, or from a mere passive admission of liquids into the vessels, in consequence of diminished resistance within, and relaxation of the vascular coats.

Respiration is sometimes, by a direct reduction of the function, thrown into great disorder, which, without attention, might easily be ascribed to an opposite cause. In very low forms of disease, in the last stage of diseases of debility, even immediately antecedent to the dying struggle, or as a part of that struggle, we occasionally see hurried respiration, the most painful sense of oppression or suffocation, and violent voluntary efforts to expand the chest, without the least evidence of inflammation or irritation of the lungs. The same hurried breathing is not unfrequently met with in infants, when debilitated by disease or depletory treatment, especially in cases in which the lungs or bronchial membrane, having been previously inflamed, are left in a weakened condition upon the disappearance of the inflammation. In the latter case, the occurrence of this condition has probably often been ascribed to an increase of the inflammation, and fatally regarded as a signal for further depletion. It is not difficult to explain this agitated state of respiration. A due amount of activity in the capillaries of the lungs is necessary to transmit the blood from the pulmonary arteries to the pulmonary veins, and thus sustain the circulation. If the action of these vessels be depressed, there is to a certain extent a stagnation of the blood, the due quantity does not reach the left side of the heart, and the due supply is not sent over the system. Besides, in a depressed condition of the proper respiratory function, the change from venous to arterial blood is more imperfectly effected; so that the blood which does circulate over the body is not in a condition to fulfil its various offices. Now this deficiency in the quantity and quality of the blood is felt in all the organs, and the sympathies which have been established, through the nervous centres, for the regulation of the various mutually dependent functions, determine, as a result of this feeling in the organs, that the respiratory movements should be more rapidly effected, in other words, that the muscles concerned in the office should be stimulated to increased action, in order that an increased supply of air should be furnished to the lungs. It is the same feeling that leads to hurried respiration in a very rarefied atmosphere, and in cases of great fatigue; and, in these cases, the end for which the sympathy was established is obtained. But, in the cases before alluded to, the feeling is delusive; as it is not an increased supply of air that is wanted, but increased activity of the proper respiratory process; in other words, the due arterialization of the blood. The violent efforts, therefore, which are often made to breathe, do not afford relief; and, unless the existing depression of the function be obviated, the patient dies. It is obvious that relief must be sought for, in these cases, from sources very different from those to which recourse is had in an over-excited condition of the lungs. Happily, the present modes of exploring these organs very greatly facilitate the forming of a correct diagnosis in the cases referred to.

The *circulation* affords more of these apparent anomalies than any other function. Allusion is not here had to the increased action of the heart, which is so frequent an attendant upon debility, and which, as before explained, is a positive irritation dependent on the increased stimulation and excitability of that organ. A depression in the action of the heart, without a corresponding depression in that of the extreme vessels, necessarily causes the blood to accumulate in the large venous trunks, and in the organs in their immediate vicinity. The heart cannot send forth the blood so rapidly as it passes from the extreme arteries into the venous ramifications, and thence into the larger vessels, in its return towards the centre of the circulation. Hence arises engorgement or congestion of the venæ cavæ, the liver, brain, &c., which is a frequent attendant of diseases of debility, and is sometimes viewed, though I believe erroneously, as the most prominent symptom, and that from which most danger is to be apprehended. Such diseases have, therefore, been named congestive diseases; and attention has been particularly directed to the treatment of the congestive condition of the organs, with the effect of calling it away from the real fountain of mischief, the enfeebled action, namely, of the heart. It is not here pretended to be denied that engorgement of the internal organs does occasionally occur as an original affection, nor that, even when it proceeds from the cause alluded to, it may very properly be the subject of special treatment: but it is highly important, in the latter case, that our therapeutical efforts should be directed mainly to the state of the circulation, or of the general forces in a failure of which the heart may participate, and that, in attempting to relieve what is nothing more than an effect, we should take care not to aggravate the cause.

Sometimes, in enfeebled capillary circulation, there are paleness and shrinking of the part, as if the blood were not allowed to enter the vessels in the usual quantity; in other cases, the blood penetrates the vessels, but is moved slowly, and, being detained till it has assumed the venous character, gives rise to a dark-red colour, which is in some instances scarcely distinguishable from that which occurs in certain stages or varieties of inflammation. This resemblance is still further increased by the circumstance, that the caliber of the relaxed vessels is sometimes augmented, probably from a loss of equilibrium between the forces which carry the blood to and from the vessels affected. Even vessels before colourless then become of a deep-red colour, and swollen, in consequence of the admission of a greater amount of blood. This state we observe not unfrequently in malignant diseases, and those of great debility. It is not uncommon for the conjunctiva of the eye, under these circumstances, to become red and swollen; and the same thing occurs upon other membranes, and upon the skin. It is an entirely different condition from that of inflammation; as it is attended with no pain or increase of heat, and none of those new products which mark that affection. It may, however, follow inflammation, which sometimes leaves the vessels enlarged and debilitated, after its own proper actions have entirely ceased. We see it frequently in diseases, such as scurvy, attended with a depraved condition of the blood, which, though it enters the capillaries, is incapable of affording them the amount of stimulus requisite for sustaining their healthy action. We see it also in persons whose circulation is enfeebled by age, particularly in the extremities, where the vital contractility of the vessels is insufficient to resist the force of gravity. From the same cause, in cases of great debility, it may be observed as the mere result of position, in the back, or in other dependent parts, sometimes even in the portion of the lung which may be lowermost. It is probable that an engorged state of debilitated capillaries, when observed in the interior organs after death, as in the mucous membrane of the stomach and bowels, has often been mistaken for the immediate effect of inflammation. When this condition occurs externally, slight pressure will frequently induce gangrene by putting an entire stop to circulation in the part.

Another occasional attendant upon depression, which might be mistaken for an effect of irritation, is hemorrhage. This depends upon debility of the blood-vessels, the coats of which are relaxed, and incapable of affording that vital resistance to the passage of liquids through them which is one of the characteristics of the healthy tissue. It probably never occurs from mere depression without positive debility. The vessels approach to that condition in which they are after death, and in which it is well known that blood often percolates through them into the dependent parts of the body. This hemorrhage of debility is common in diseases in which the blood loses in part or altogether its coagulability, as in malignant typhus, and some cases of purpura and scurvy. It is apt to proceed from the mucous membranes, particularly from those of the nostrils and the bowels; and to a very slight extent is common in the skin, constituting the petechiæ which are so often present in the above-mentioned diseases.

The result which might be inferred from depression of the *nutritive function* is *atrophy*, or loss of substance in the organs, which may be universal, affecting all parts of the body, or confined to some one part or organ. Atrophy, however, is not always necessarily the result of depressed nutrition. It may originate also from an excessive activity of absorption, the nutritive deposition not being diminished in quantity. This is probably the case in those instances of universal emaciation which are accompanied with a good appetite, and apparently active digestion. But there is reason to believe that diminished energy in the process of nutrition, instead of being attended with loss of substance, is sometimes actually productive of excessive growth. The amount of organizable matter eliminated from the vessels is by no means an accurate measure of the activity of the function. An excess of this matter may escape from debilitated capillaries from a want of the due degree of contractile action necessary to prevent its egress. Nutrition requires not only an elimination of the organizable material, but also a process of organization; and it is only when this process is efficiently conducted, and in due relation with the excess of matter acted upon, that the function can be asserted to be in a state of positive exaltation. If the organizing process is incomplete, or inadequate to the conversion of the material into sound and healthy structure, nutrition may be, in fact, in a depressed state, even along with excessive growth. An example of this we have in fungous granulations, arising from debility of the granulating surface. It is not uncommon for this sort of morbid growth to be produced in wounds or ulcers by local or depressing applications. Emollient poultices, which, in consequence of their moisture, are positively depressing, often produce this effect when too long continued. The weakened vessels allow the escape of an excess of material, while there is insufficient energy to produce a sound organization; and the new structure, though too abundant, is of a loose flabby consistence, incapable of performing the proper office of healthy granulations, and possessed of a very feeble vitality.

In relation to *secretion*, though a diminution of the amount of secreted matter is the usual consequence of a depression of the function; yet the same condition is not unfrequently attended with a great increase of product beyond the normal quantity. The immediate cause is probably the same as in the cases of hemorrhage and excessive nutrition. The vascular pores or secreting orifices of the capillaries lose, in the relaxation of debility, that vital organic contraction which resists the mere mechanical exit of fluids, or they, together with the cells which are thought often to be the agents of secretion, lose that vital power of election and elaboration by which peculiar secretory products may be formed out of the blood, of which, therefore, the more fluid parts escape, often in great abundance, and with little modification. The profuse sweats so frequent in debilitated states of the system, and which are most abundant in sleep, because, in that condition, the organic actions in general, and consequently that of the skin, are less energetic than in the waking state, are examples of this kind. So are, in many instances, diuresis, diarrhœa, and dropsical effusion; and, in a less degree, the excessive pulmonary secretion which sometimes follows bronchial inflammation, after the inflammatory action has subsided, and the excessive secretion of a badly elaborated pus, which sometimes takes place from the debilitated or relaxed surface of ulcers. This excessive secretion, or perhaps we should rather call it exhalation, dependent on debility, is most common in a watery condition of the blood, in which the material for the exhalation is most abundantly offered, while the stimulant property, which tends to sustain the proper healthy energy of the secretory process, is diminished. There is another mode in which secretion is produced by a depressing or sedative agency. It has already been stated that a certain degree of excitement checks secretion. The skin is usually dry in fevers, because excited beyond the point of perspiration. Depress the action of the over-stimulated vessels, and secretion is restored. Thus, the application of cold water to the hot and dry surface of the body, in the febrile state, will often induce perspiration; and the same result frequently follows the internal administration of nauseating substances which relax the skin.

The influence of depression in indirectly inducing irritation, either in the same part, by increasing the excitability and thus giving rise to reaction, or in other parts, by directing away from its own seat a portion of the circulating fluid and nervous energy, and thus concentrating them elsewhere, has already been sufficiently treated of.

Though depressing causes do not necessarily produce real debility when they act but for a short time, and, under the same circumstances, often increase excitability; yet, when long continued, they do occasion both debility and diminished excitability. A part which, if restrained from action for a brief period, will afterwards often act more energetically, under a long continued restraint, loses at length its susceptibility and its power of action, and becomes as it were paralyzed. This result is probably connected with the want or defect of nutrition under such circumstances. Again, if the restraint be continued remittingly, so as to allow of occasional reaction, or steadily, in so moderate a degree that the accumulated excitability may at times overbalance the depressing cause, and occasion super-excitement, still, ultimate debility, or exhaustion is produced. The excitability is either worn out by undue exercise, or, the parts affected being thrown into irregular reaction beyond their depressed powers, organic mischief results. When the depressing agent is intermittingly applied, with intervals sufficiently long to admit of the full influence of the natural recuperative powers, if the system escape immediate injury, no ultimate evil is experienced; but, on the contrary, an invigorating effect may be produced by rousing the sleeping energies into action. Thus, the occasional application of cold to the body, alternating, as in civilized life, with a comfortable temperature, often produces a healthy excitement by the reaction which it calls forth; but, if long continued, with little or no remission, it either directly destroys life, or gives rise to a general debility which causes the system to sink into a typhoid state, whenever attacked by disease; while, remittingly applied, it is apt to occasion troublesome reaction, in which the excitement is not supported by the powers of the part, as in the case of frostbite or chilblain, not unfrequently ending in ulceration or gangrene.

Depression may end in organic changes quite as serious as those which follow inflammation; nay, there is reason to believe that two of the most important results of this kind, which flow from the latter cause, may occasionally be produced in a direct manner by the former, namely, softening and mortification.

Softening.—This has already been treated of as one of the effects of inflammation. But it not unfrequently happens that a part is found, upon examination after death, to have completely lost its healthy tenacity, and even to have been reduced into a sort of pulp, without the least evidence, other than the softening itself, of inflammation having existed either in the part affected or the neighbourhood. Even the granular corpuscles, so common an attendant on inflammatory softening, are not detected in this variety; at least, Dr. Hughes Bennet could not discover them in non-inflammatory softening of the brain. The colour of the part is unchanged, there is no injection of the blood-vessels, and none of those peculiar products are observable which invariably attend inflammation when severe and lasting. The result is to be ascribed to a direct loss of vital power and action, interfering with the healthy performance of the ordinary nutritive process. In other words, it is a deranged and reduced nutrition of the part. That the softening does not proceed from the absolute loss of vitality, and the entrance of the part within the domain of chemical laws, is evinced by the absence of fetor, which always attends putrefaction. Softening, therefore, differs from gangrene, though, in its extreme forms, it may end in the death of the part. It may arise either from the absence of those constituent particles or molecules upon which the hardness of particular structures depends, as in the case of rachitis, in which the earthy salts are not deposited in due proportion, or from a want of due firmness in all the particles, or of due vital cohesion between them.

Softening may affect the tissues generally, rendering the bones brittle or flexible, the muscles flabby, the cellular tissue lax, and all the soft parts of the body less firm and resistant, as in some cases of scrofula, in scurvy, and in persons living on a meagre diet, in whom the blood is incapable of yielding proper support to the process of nutrition. The affection, moreover, may be confined to particular portions of the body, as for example to a paralytic limb; or still more narrowly to some single organ, as the heart, the stomach, or the brain. It is not unfrequently quite circumscribed, and limited to a very narrow space. It is often associated with atrophy, and arises from the same causes. Even when the result of inflammation, it may, at least in its advanced stages, be still considered as directly flowing from a depressed condition of the nutritive function, consequent partly on the previous excessive excitement, partly on the local obstruction of the circulation; and, in this case, may be regarded as a forerunner of gangrene.

Care is necessary, in post-mortem examinations, not to confound this condition with cadaveric softening, which may result from the infiltration of the solid parts with fluids, from the solvent action of the gastric juice, or from incipient putrefaction.

Fatty Degeneration.—Another organic result of depression is fatty degeneration. It has long been known that flesh, under certain circumstances of exclusion from atmospheric air, is converted into a fatty matter called adipocire. This fact suggested to Dr. C. J. B. Williams that the fatty degeneration occurring during life might be equally a result of chemical action. Dr. Quain found that, by immersing muscle in dilute acid, so as to prevent the putrefactive process, the pathological fatty degeneration of that tissue might be closely imitated. The inference from these facts is, that, when the organic tissues are so far withdrawn from vital influences as to allow the predominance of chemical affinities, without being completely surrendered to them as in putrefaction, the tendency of these tissues is to yield fatty matter as one of the results of their decomposition. If, therefore, any part is greatly depressed, whether from the want of due vital influence, or from an insufficient supply of material for its nourishment, chemical reactions may take place, by which the tissues of the part may to a greater or less extent be converted into fat, the other products of the decomposition being carried off by the absorbents, or in some other way eliminated. There is reason to believe that this result very frequently takes place. It is of no consequence whether the depression is indirect, as in the advanced stages of inflammation, or direct, as when a due supply of blood is withheld. The formation of pus, one of the first results of depression in inflammation, is always attended with the production of fat, and the degeneration of the pus corpuscle into the granule-cell has been shown to be mainly an oleaginous transformation. It is probable that the pus corpuscle differs from the fully formed exudation corpuscle in which it originates, simply in the loss of vitality in the latter, and the consequent generation of oil within it. In fatty degeneration of the heart, liver, and kidney, from depression of the nutritive function, oil may be seen, upon microscopic examination, occupying the place of the proper muscular structure within the sheaths of the fibrils, and of the proper contents of the secreting cells in the glandular parenchyma. This sort of fatty degeneration is wholly different from the excessive secretion of fat which results from an overabundance of the material of nutrition, or an overaction of the nutritive function, constituting morbid obesity. In the latter case, fatty matter is deposited in addition to the normal structure, and, if it interfere with it, does so by producing absorption through pressure. In the former case, the normal structure itself undergoes degradation.

Calcareous Degeneration.—This is still another organic result of depression. In this affection molecules of earthy matter, generally with a calcareous base, take the place of the normal tissue, and often to such an extent as to give an almost bony hardness to the part. It is very apt to occur in the coats of the blood-vessels; but may take place in any of the tissues, and, indeed, is frequently found in abnormal structures or deposits, as in the false membrane of inflammation, in tubercle, and in cancer. Whether it is the result of the disintegration of the tissue leaving its earthy components behind, or a direct deposition from the blood, supplying the place of the absorbed structure, has not been determined; but the probability is that it proceeds from both these sources. It is very analogous to the fatty degeneration, occurring under the same circumstances, and not unfrequently along with it. Both are very common in the old, in whom they seem to be regular consequences of the failing powers and actions of life, rather than morbid changes; capable it is true, like other normal processes, of producing injury by excess or malposition, but on the whole forming one of the physiological series of vital processes beginning with the impregnated germ, and ending with the last breath of expiring old age. The arcus senilis, or grayish-white circle often observable in elderly persons near the edge of the cornea, has been ascertained to be a fatty degeneration, generally coincident with a similar change in various internal parts of the body; and the ossification of the arteries, so common in the same class, is an example of the calcareous degeneration.

Gangrene.—This has already been defined to be the death of a part, without the death of the whole body. From whatever cause it may remotely proceed, it is obviously the direct and the last result of a state of depression. If it follow an excitement too violent for the vitality of the part to support, it is nevertheless the immediate consequence of the depression which necessarily ensues after such excitement. If it result from inflammation, through the interruption which this sometimes produces in the supply of blood, the direct cause is still the depression which arises from the absence of the vital and essential stimulus. If it be traceable to a complication of certain morbid poisons or depraved states of health with inflammation, such as occur in anthrax, hospital gangrene, malignant pustule, &c., it is to the depression occasioned partly by the direct agency of the superadded cause, partly by the exhaustion consequent upon the inflammatory excitement, that the gangrene is to be ascribed. But it is often also the direct result of depression, without any pre-existing inflammation, or excessive action in the part affected. Such is the case with gangrene following an interrupted supply of blood, occasioned by pressure upon the arteries, by the accidental destruction of the vessels, by the obliteration of their cavities by means of coagulated blood or fibrin, or by certain diseases of the heart, which disable it from transmitting to the extremities the necessary quantity of blood for the support of their vital actions. Such also is the case with the gangrene produced by certain positively depressing agents, as excessive cold, large quantities of ergot, and local violence so great as to destroy the life of the part without reaction.

There is in gangrene a total absence of all the phenomena of life in the part. There is no sensibility, no circulation, no active movement whatever, no generation of animal heat. But these are not unequivocal signs of the loss of vitality. They may all exist, and yet the part may be living, and, with proper care, may be restored to its healthy actions, as not unfrequently happens after the apparent death of a part from cold, violence, or some mechanical interruption to the circulation. It is of the greatest practical importance that, in such cases, the apparent should not be mistaken for real death, to the neglect of proper measures of restoration. The only certain sign that mortification has really occurred is the commencement of putrefaction. This, under ordinary circumstances, always takes place sooner or later after the death of the part. But, though it is indispensable as a sign, gangrene may occur and continue to exist for a considerable time without it, as when resulting from cold, or in parts destitute of fluids or secluded from the air. Sometimes putrefaction is concurrent with the mortification, especially when the latter is the consequence of inflammation, and the part is exposed to the conjoined influence of air, moisture, and warmth. Besides loss of sensation, vital movement, and animal heat, there is generally, even in cases where putrefaction has not taken place, a change of colour and consistence, dependent partly upon alterations antecedent to the loss of vitality, partly upon those simultaneous with the mortification. Putrefaction is the decomposition which occurs under the influence of chemical affinities. In this condition, there is an offensive odour consequent upon the disengagement of fetid gases, usually more or less emphysematous swelling, infiltration with dark, turbid liquid, and a loss of cohesion. In some instances, however, as in dry gangrene, the parts are hard, shrunk, and dry, like the flesh of mummies; and the smell, though fetid, is much less so than in ordinary cases.

In the state which precedes gangrene, in that which is presented by the living parts in the vicinity of the dead, in the progress of the affection, and in the earlier or later occurrence of putrefaction, there are sources of such diversified and complicated phenomena that it would be wholly out of place, in a general treatise, to attempt to describe all their possible combinations. When the gangrene has originated in inflammation, the phenomena of the latter affection in its various stages, are mingled with those of the former. It may be proper to mention here that, though sensibility is usually diminished in the progress of the mortification, violent pain is sometimes experienced, as in the gangrene which attacks the extremities of old persons. In such cases, it is possible that the nerves may preserve, for a time, their vitality in the midst of the mortified structure, and thus be exposed to irritation from the contact of what has now become foreign matter. Sometimes the mortification advances gradually without any apparent disposition to set limits to its extension, till it has destroyed the life of the patient. Generally, however, it is either confined to the spot originally affected, or is arrested at some point of its progress; in which case, inflammation occurs in the living parts in contact with the dead, and the latter are separated by ulcerative absorption, as already described under the head of inflammation. Occasionally, when the constitutional tendency to gangrene is strong, mortification recommences, after having been temporarily arrested; and this alternation may occur several times, till at length the affection ceases, or the patient dies. The period required for the separation of the slough is exceedingly various, according to the vigour of the constitution, and the nature of the part affected. Under favourable circumstances, as in persons of good constitution and previously vigorous health, and in soft highly vital parts, the separation is effected in eight or ten days; but, under opposite circumstances, it is sometimes greatly protracted, even to two or three months or more.

The degree of danger from gangrene varies with its extent, the importance of the organ affected, the previous condition of the patient, and the nature of the attendant diseases. When external, and of moderate extent, it seldom proves fatal; while a patient often very rapidly succumbs under a very limited internal mortification. Still, life is sometimes preserved, though a considerable portion of some internal organ may be gangrenous. Large portions of the bowels have sloughed away, and been discharged per anum, and yet the patient has recovered. A previously feeble state of health, or the coexistence of some depressing malady, very greatly increases the danger. In cases of internal gangrene, the danger is also increased by the liability to the absorption of the offensive and depressing products which result from putrefaction. Other sources of danger, in cases of extensive gangrene, are hemorrhage from the sloughing of large arteries, and the exhaustion consequent upon excessive suppuration, during or after the separation of the slough. Gangrene has sometimes proved curative by attacking exclusively some morbid structure, as the cancerous, for example, which, if not thus destroyed, would have gone onward to a fatal issue. As gangrene presents phenomena somewhat different according to the tissue which it occupies, it will be proper to trace it, at least briefly, through the different tissues.

In the *areolar* or *cellular tissue*, gangrene is very apt to occur as a consequence of carbuncle and erysipelas phlegmonodes, and when parts in a state of ordinary inflammation are bound down by strong fibrous expansions. It is sometimes in this situation very extensive, destroying the cellular tissue which connects other structures, and dissecting out, as it were, muscles, tendons, blood-vessels, and nerves. When it affects the subcutaneous cellular or adipose membrane, the skin over the part affected often assumes a gangrenous appearance, and portions of it slough away, or numerous orifices are made by ulceration, so as to permit the escape of the dead tissue. The colour of cellular membrane, in a state of gangrene, is a dirty-white, or yellowish-white. By putrefaction it is converted partly into a grayish, very fetid pulp, which is often mixed with pus, and more or less with blood. When discharged through ulcerated openings in the skin, it often has the appearance of wet tow.

The *serous tissue* seldom mortifies, unless in connexion with other tissues to which it is attached, as when all the coats of the bowels slough in strangulated hernia. When it does mortify, it becomes black, of a soft, almost pulpy consistence, and excessively fetid; imparting, however small the extent of the gangrene, the same fetid odour to the liquid effused into the serous cavity, in which also it produces an evolution of offensive gases. When false membrane exists, it sometimes participates in the affection, presenting the same phenomena as the proper serous tissue.

The *fibrous tissue* is among those in which gangrene is established with the greatest difficulty. This is especially true of tendon. Nevertheless, these structures do occasionally undergo mortification. Their appearance is at first little altered; and it is sometimes difficult to decide, by the colour alone, whether they are dead or living, until the appearance of a red line of inflammation indicates the limits of the gangrene. But, when long dead, or when the mortification is of slow occurrence, they lose their shining appearance, become grayish or of a dirty yellowish or ash colour, and soften so that they may be torn, though they are longer in separating than most other parts.

The *skin* is more liable to gangrene than any other tissue, unless it may be the areolar. The appearances which it presents, immediately before the death of the part, have been already described. (*See page* 34.) After mortification has taken place, the surface, if moist, is of a grayish or ash colour; if dry, is darker and even blackish. When the gangrene has resulted from excessive cold, or sudden violence, the colour is at first often white or yellowish, and ultimately assumes a darker hue. The affected portion of skin is usually soft, though somewhat consistent; if the mortification has occurred during suppuration, it is still softer; and, if the subcutaneous cellular tissue has been at the same time inflamed, it is converted into a grayish pulp, and mingles with the ichorous pus from the parts beneath. In dry gangrene the skin is dry and shrunk.

In *mucous tissue*, which is occasionally, though not very frequently, the seat of gangrene, the mortified part is fetid and very soft, so that it may be readily removed by scraping with the back of a scalpel from the subjacent structure. The colour is sometimes white at first, but is ultimately gray, slate-coloured, or blackish. When the gangrene is consequent upon inflammation, the neighbouring parts are usually of a livid redness, very soft, and considerably swollen from the infiltration of a fetid, bloody, serous fluid.

In the *glandular tissue*, gangrene is not frequent, and, when it occurs, presents the ordinary appearances which characterize the affection. In the *blood-vessels*, it is exceedingly rare as an original affection, the vascular tissue having an extraordinary power of resisting mortification, and often remaining sound in the midst of a mass of gangrene. Little is known of the affection in the absorbents, though the lymphatic glands occasionally undergo mortification. *Muscles*, in a state of gangrene, are usually of a dark livid colour, though sometimes, when not exposed to the air, they are yellowish or grayish, and are black in dry gangrene. Gendrin states that gangrenous eschars of the heart are blackish or greenish. Mortification is very uncommon in *nerves*, unless when pervading the whole structure of which they form a part. It occasionally occurs in the *brain*, though rarely. In this structure, the gangrenous part is gray or blackish, very soft, and very fetid. But fetor and softening are not certain signs of mortification; for the latter is often produced by inflammation, and the former may occur from the decomposition of the pus, when from any cause, as in cases of external violence, air has admission to the part. In *bones*, gangrene is not unfrequent, and is perhaps produced more readily by an equal amount of cause than in any other tissue. The mortification of bones is attended with phenomena somewhat peculiar, which have given it a distinct name, and have led to especial attention. It is usually denominated *necrosis.* Of this affection, however, as it is considered as falling within the province of the surgeon, I shall not treat in this place. It is sufficient to say that it may occur as a result of inflammation which the feeble vitality of the tissue is unable to resist, or from direct depression through the agency of cold or an interrupted supply of blood, as when the periosteum or medullary membrane, upon which its nourishment depends, is separated from the bone or destroyed. The dead portion of the bone is separated by ulcerative absorption, and through the same agency is ultimately discharged, if the patient do not sink during the process. The mode of separation is highly interesting, and affords a beautiful illustration of the resources of the system; but the reader is referred to works on surgery.

The effects upon the system produced by gangrene, when extensive or internal, especially when it affects a vital organ, are very striking. The pulse is very feeble and frequent, and often irregular; the skin is pale or of a sallow tinge, and is bathed in a cold clammy sweat; the respiration is disordered; the features are sunken, with an expression of wildness or great anxiety, though no pain may be felt, and the sudden cessation of any pre-existing pain is considered as an evidence of commencing mortification; there is usually great thirst, and frequently more or less nausea and vomiting; the abdomen is often tympanitic; and great disorder of the nervous system is evinced by subsultus tendinum, singultus, deranged sensations of various kinds, and even delirium. But these symptoms, which, occurring in the last stage of inflammation, and especially when attended with a sudden cessation of pain, were formerly very commonly considered as certain proofs of mortification, are now known frequently to take place in cases which exhibit no appearances of gangrene after death. The probability, however, is that, in many of these cases, gangrene is not discovered only because the patient sinks under the disease before the local affection has had time to run into absolute mortification; and that, in others, though death may have occurred in the part, yet general death has so speedily followed, that no time has been allowed for the commencement of putrefaction, which, as before observed, is the only unequivocal sign of gangrene.

Article IV.

CONGESTION.

This may be defined to be an unhealthy accumulation of blood in the blood-vessels of any part of the body. It often has its origin and chief seat in the capillaries; but it may extend also to the arterial and venous ramifications, and even to the larger trunks. It is considered by some writers as of primary importance in disease; but it is always an effect of some pre-existing morbid state or action; and it is a partial view which is directed to this effect alone, without embracing the other elements that enter into the complex phenomena presented by the part congested. There is probably no form of congestion which may not be traced to some one of the morbid affections already described; and its varieties have consequently been treated of along with the other phenomena or effects of these states respectively. Yet a general connected view of the subject may, perhaps, be proper, in reference both to the real importance of congestion as itself, in many instances, a source of inconvenience or danger, and to the prominence which has been given to it by some practical writers.

There are three distinct sources of congestion; namely, 1. irritation or inflammation; 2. depression; and 3. some purely physical agency. When it proceeds from the first cause, it is obviously attended with phenomena of over-excitement, and is hence called *active congestion;* and, as the accumulation takes place more especially in the arterial ramifications, and the blood accumulated has usually the arterial character, it is sometimes also denominated *arterial congestion*. When produced by either of the two latter causes, the accumulation is merely a consequence of some interruption in the regular flow of the blood, and not of any positive agency, forcing or soliciting a greater amount than usual of that fluid into the distended vessels. The congestion is, therefore, under these circumstances, called *passive*, and sometimes, though perhaps with less propriety, *venous;* for, although the affection is in many instances confined chiefly to the veins, it is not necessarily so in all. I shall treat of congestion under two distinct heads, corresponding with these two conditions.

1. *Active Congestion.*—The reader must be familiar with the fact, so prominently stated on former occasions, that in every case of excessive capillary excitation, there is an increased flow of blood to the part affected, and an accumulation in the vessels of that part. Now any excessive or unhealthy excitation is, according to the views and nomenclature adopted in this work, either irritation or inflammation, the former ending where the latter begins. The congestion, therefore, is nothing more than a phenomenon of one of these affections. But authors usually restrict the application of the term to that condition in which the vessels are merely engorged, and the peculiar symptoms of inflammation have not yet made their appearance. Congestion, therefore, in this limited sense, is simply a phenomenon of irritation. To consider it as in itself the disease, is to take a mere sign for the substance. Where is the real seat of the morbid action? Certainly not in the blood. It must, therefore, be in the vessels themselves. Now an action of the vessels, though it may cause, cannot itself constitute congestion. This is consequently not the proper morbid action. The disease is, in fact, some peculiar modification, not well understood, of the solid tissues, of which a change in the innervation probably constitutes an essential part, and which is induced by the operation of some excitant, unhealthy either in its nature or degree. In other words, it is irritation. They who regard the congestion exclusively, overlook the important circumstance of the nervous derangement.

Even within the limits of healthy excitation, much accumulation of blood often takes place, which is not called congestion, simply because it is not morbid. We have examples of this in the erectile tissues, as the nipple and the penis; in organs called after a period of repose into renewed action, as the stomach during digestion, and the uterus during menstruation; and in parts no matter where situated, which have more than their ordinary duty to perform. In these instances, there is often great distension, with increased redness and heat; but the parts return again to their usual state in a short time, without having suffered injury or inconvenience. The process is entirely healthy. If, however, the excitation increase or persist so as to induce a derangement of function, it then amounts to irritation, and the attendant sanguineous engorgement is a real congestion. From what has been said, it is evident that the causes of active congestion are those already treated of under the head of irritation. The same may be said of its phenomena and morbid effects. The latter, however, may be summed up in a few words. There are distension, increased redness and heat, and usually some unpleasant or deranged sensation, as a feeling of fulness, weight, or oppression; but no positive pain, unless the disease amount to inflammation. The functions of the part are always modified, being often increased, when the affection is moderate, and deranged, diminished, or altogether suspended, when it is severe. Hemorrhage from the distended vessels is not uncommon. It is now generally thought by microscopists to proceed from rupture of the vessels, the possibility of the passage of the unbroken blood corpuscles through their coats being denied. There is, besides, a derangement or suspension of those functions which are dependent for their proper exercise upon a certain influence from the part affected. Hence, disordered vision and hearing, disordered sensation generally, and paralytic affections, are often consequent upon congestion of the brain. Active congestion may even terminate in disorganization of the part, the result being ascribable, when not produced by inflammation, to a depression consequent upon a preceding excess of excitement.

But I wish again to urge the consideration, that all these effects do not proceed merely from the local accumulation of blood. This is undoubtedly an important circumstance, and may be the means through which much injury may be inflicted; but it is only a circumstance, and the judicious practitioner will look beyond it to the true pathological condition. It is fortunate, however, that the means obviously calculated to relieve the congestion are generally, in this variety of the affection, those most efficient in the cure of the disease itself. Still, it is highly important to consider the particular character of the irritation in which they originate, as this will very much modify the extent, and, indeed, the nature of the treatment.

2. *Passive Congestion.*—This condition is very different in its origin, character, and indications of cure from that just noticed. The blood is neither attracted nor forced, in unusual amount, into the vessels of the part, but accumulates in them, because not carried forward so rapidly as it enters with the ordinary movement of the circulation. The impediment to its onward progress may, as before stated, arise from two distinct sources; namely, from a want of a due degree of that action which is necessary to its transmission, that is, from depression, or from some physical difficulty or obstruction.

The depression giving rise to congestion may be general, or confined to a particular organ. Nothing is more common than the occurrence of this condition, in diseases attended with great and sudden prostration. The heart, participating in this prostration, is unable to transmit the blood so rapidly as it is conveyed towards it by the continued action of the capillaries, and by the forces which move the blood in the veins. This fluid, therefore, necessarily accumulates in the right side of the heart, and the great venous trunks, and consequently in those organs with which these trunks more immediately communicate, viz., in the brain, liver, and, through this latter organ, in the abdominal viscera in general. Instances of congestion from this cause are constantly occurring. A blow upon the head, or any severe shock, temporarily paralyzing the cerebral actions, certain mental emotions which tend to produce syncope, the chill of fevers, especially those of a typhous or malignant character, and the prostration of violent intestinal and stomachic spasm, all occasion internal congestions consequent upon depression in the movements of the heart. But it would be a great error to ascribe the alarming phenomena which attend these affections, the feeble pulse, the cold extremities, the pale and shrunken skin, and the frequently suspended or impaired intellectual functions, to the congestion, which is a mere effect of the prostration, and ceases when the heart resumes its usual energy. Yet there are not wanting practitioners who overlook, in great measure, the collapse of the nervous system, and the feeble movements of the heart, overwhelmed as they both are under some powerfully depressing influence, to search for the chief source of danger in the internal sanguineous engorgement; and who direct their remedies accordingly. Indeed, so far has this mode of viewing things been carried, that affections of the kind alluded to are not unfrequently distinguished by the title of congestive diseases; a mere effect being thus prominently set forth as the characteristic and most important feature. It is scarcely necessary to say that serious practical injury may grow out of this error, especially in cases where the depression, as not unfrequently happens, is attended with real debility, and is not a mere fugitive result of some temporary cause.

Congestions frequently also arise from local depression, affecting especially the capillaries of the part. From causes directly or indirectly operating on these vessels, such as have been already enumerated under the head of depression, they become incapable of performing their usual part in sustaining the onward movement of the blood, which, therefore, accumulates in the vessels behind them, especially when these latter vessels happen to be the recipients of venous blood. Thus, when the capillaries of the lungs become depressed, the venous blood, carried regularly towards the right side of the heart, and thence sent into the pulmonary arteries, accumulates in the ramifications of these vessels, distends their trunks, and even loads the right ventricle, so as to produce great venous engorgement of the lungs and heart. So also in the liver. A depression of the capillary circulation in this organ, leads to accumulation in the whole portal system of veins, not only in its hepatic ramifications, but in the vessels and their radicles, which convey the venous blood from the abdominal viscera to the vena portæ. Hence arise congestions of the stomach, bowels, spleen, and liver. Depression in the capillaries of a secreting organ may also promote congestion by diminishing secretion. That part of the blood which is usually thrown out by the secretory process, remains in the vessels, and produces a greater fulness than in their ordinary state.

After inflammation, the capillary vessels are often left in an enlarged and relaxed condition, which admits the entrance of the blood, by means of the *vis a tergo*, in greater quantities than in the healthy state, and thus occasions congestion. In this case, the congestion is entirely passive, and to be removed by means calculated directly to produce contraction in the vessels. An example is afforded in the blood-shot appearance of the conjunctiva, wholly destitute of symptoms of inflammatory excitement, which is occasionally left behind by a retiring ophthalmia.

Congestion from purely physical causes is not uncommon. It is often produced, in a certain degree, by the mere force of gravitation. The blood accumulates in the vessels of a dependent part of the body to an inconvenient extent, even in health, by a too long continuance in one posture. But, in cases of debility, in which the vital actions are less capable of countervailing the opposing physical forces, such congestion is more common and more troublesome. For an obvious reason, it is most apt to occur in the lower extremities; but it may also be observed in the posterior portions of the body, in individuals who from weakness are compelled to be long upon their backs; and it is asserted also to take place in the most dependent parts of the lungs, in the same individuals. This form of congestion is by some writers called *hypostatic*. Whatever obstructs the return of blood along the veins towards the heart, or in its passage through the heart, is capable of producing passive accumulations in parts behind the point of obstruction. (See *page* 13.)

These passive congestions, whatever may be their source, are often productive of inconvenience, and sometimes of danger. There is often a sense of fulness, weight, or oppression accompanying them, but usually no increase of heat; on the contrary, sometimes a reduction of the habitual temperature of the part; and the redness is of a dark, or purplish, or even blackish hue. The sensibility to ordinary impressions is often diminished. The serum of the blood is apt to escape from the vessels, producing œdema, or dropsy of the cellular tissue and serous cavities. Hemorrhage, of the kind denominated passive, is not uncommon; the blood appearing to percolate mechanically through the parietes of the debilitated vessels. All the functions of the part or organ are more or less deranged, and even fatal disorganization may ensue. It is difficult, however, always to determine how much of these injurious consequences is due to the mere congestion, and how much to the continued operation of the depressing cause. It is, in any event, however, very obvious that the remedies must be addressed, not to the mere abstraction of the blood, but to the removal of the cause upon which the congestion depends. When the affection is connected with general debility, this remark is peculiarly applicable. Bleeding, in such cases, though it may have a temporary effect in diminishing the congestion, by lessening the current which is setting constantly towards the congested vessels, endangers an increase of the debility in which the congestion originates, and in which the chief danger lies.

There are instances in which positive irritation originates in passive congestions; the blood accumulating in vessels which retain their healthy excitability, and stimulating these vessels into excessive action. Thus, in congestion of the portal system of veins, dependent upon a depressed condition of the capillary circulation of the liver, the venous radicles in the intestinal mucous membrane share in the congestion, and are unable to receive the blood from the arterial radicles and capillaries, which, therefore, become distended and irritated. This irritation not unfrequently relieves itself by profuse secretion; and severe and exhausting diarrhœas result.

The appearances of congestion may be presented after death, although none may have existed during life. These may occur at the moment of death, or not till some time afterwards. The contractility of the arteries appears to remain, for a short period, after respiration and the movements of the heart have ceased, so that these vessels empty themselves into the capillaries, where the blood is retained, and presents, upon post-mortem examination, the phenomena of congestion in various parts of the body. This is particularly apt to occur, when the patient has died in a plethoric state. Cadaveric congestion, occurring after death, is not uncommon, and, as in the former case, is most striking when the vessels are left, at the close of life, full of blood. From the influence of gravity, this fluid seeks the vessels of the most dependent parts; and, as the body commonly lies on the back, the appearances of congestion are most frequently presented in the skin and adipose tissue of the posterior parts of the body, in the meninges which cover the cerebellum, the posterior lobes of the brain, and the spinal marrow, in the posterior portion of the lungs, and in those parts of the stomach and intestines which are lowermost in the supine position. (*Andral.*) It is necessary to bear the facts here stated in mind, in order to avoid drawing false inferences from post-mortem examination. Cadaveric extravasation of blood also frequently takes place, staining red the parts in the vicinity of the vessels from which the blood escapes, or forming collections more or less extensive in the cellular and serous tissues. According to Andral, it is only the serum and red globules that are thus extravasated, the fibrin remaining in the vessels.

Article V.

FEVER.

The claims of fever to a distinct consideration in this place rest upon the fact, that it is a constituent of numerous diseases, and, though by no means simple in its nature, has not yet been, and probably never will be, satisfactorily analyzed. It is necessary, in the first place, in order to avoid confusion, to call attention to two distinct applications of the term fever. It is used, in a general sense, to signify a peculiar morbid condition of the system common to many diseases; in a special sense, to designate these diseases individually or collectively. Thus, we say of certain complaints presenting certain characters, that they are *fevers*, and of each one of them, that it is a *fever;* and distinguish the several complaints by some characteristic epithet, as when we speak of *intermittent fever*, *typhus fever*, *yellow fever*, &c.; while the term *fever*, in a general sense, is applied to the morbid affection of system found in each one and all of these diseases, and giving them, though in other respects widely different, that similarity of character which entitles them to their common name. It is in this latter sense, exclusively, that the term is here employed. This affection is sometimes called *the febrile movement*, in order to express the idea that it consists of a series of actions, rather than of a particular morbid condition; and the term is perhaps more strictly correct, if intended to embrace the whole progress of the affection, in its forming stage and decline, as well as in its state of complete developement.

Much difficulty has been experienced in defining fever. There are certain symptoms, which, when associated, leave no doubt of the existence of that affection; but they are not all present at every stage, and in every case of the diseases usually denominated fevers; and there is no one of them which is not occasionally absent. This has been considered as an insurmountable obstacle in the way of a satisfactory definition. But the difficulty has arisen, in part, from confounding the special diseases with the morbid affection common to all. Thus, a definition has been thought imperfect, if it embraced any morbid state or action not found in every particular case, and in every stage, of every febrile complaint. If each one of these complaints is a fever, it is said, nothing can be an essential constituent of fever in general which is entirely absent in any part of its progress, and still less, if absent throughout its whole course. But the fact is, that, though each disease called a fever must, in order to be entitled to the name, present the phenomena of fever in general, at some period of its ordinary course; yet these phenomena do not constitute the whole affection, and may be quite wanting at certain stages of the disease, and even in some entire cases, which terminate fatally before they have gone through the regular series of morbid changes. Thus, in the fever and ague, the patient, during the intermission, is undoubtedly labouring under the disease named *intermittent fever;* but he cannot be said to be affected with *fever*, in the general sense of that term. In those cases of malignant typhus, in which the system never rises out of the prostration of the chill at the outset, though the patient may be said to die of *typhus fever*, yet it cannot be assumed that he was in the morbid condition here called *fever*, having perished before that condition was established. A patient in the first, or forming stage of a febrile disease, is not in a state of fever. As well might we say that a part, whose actions are violently depressed by the sedative influence of severe cold, is in a state of inflammation, because inflammation takes place when reaction ensues. The general depression which often ushers in fever, bears to it a relation analogous to that which the local depression bears to the subsequent inflammation. In the first case the patient may die, and in the second case the part affected may die, before reaction; and then neither fever nor inflammation is established. Hence the necessity, in order to attain precision, either in thought or description, to distinguish, as I have endeavoured to do, between the state of system called fever, and the various diseases called fevers in which this state occurs.

Definition of Fever.—Fever is an acute affection of the system, in which all the functions are more or less deranged; the most striking phenomena being sensorial or nervous irregularity, increased frequency of pulse, increased heat, and disinclination for food. It will be observed that, according to this definition, the essence of the affection is universal derangement of the functions. The phenomena specially mentioned are merely the expression of this derangement in the functions most prominently affected. But fever, not being a simple morbid action, may be only partially developed. Of the various derangements which enter into its constitution, one or more may be occasionally or temporarily absent. The circulation, for instance, instead of being excited, is sometimes, under certain extraordinary influences, in a state of depression, or even of apparent health. So also with the calorific function, which occasionally does not exceed the healthy standard, and still more frequently falls below it. Nevertheless, except in the forming stage, when fever is not yet established, and in the declining stage, when some of its peculiar movements have ceased, a frequent pulse and morbid increase of heat are very seldom wanting; and fever is not complete without some derangement of the circulatory and calorific functions. Indeed, so general and striking a phenomenon is heat in fever, that it has given origin to the name by which the affection has been designated in most languages. In relation to the other phenomena mentioned, such, namely, as indicate sensorial or nervous irregularity, and an impaired condition of the digestive function, they are never quite wanting in fully developed fever; and, in the details which follow, abundant evidence will be afforded that not a single function is, under the same circumstances, in a perfectly healthy state.

1. *Phenomena of Fever.*

The slightest consideration will show that it is impossible, in a general view of fever, to present in detail all the phenomena which may occur in all its varieties. The affection is necessarily subject to great diversity. Not only is the general grade and course of action different in different cases, but the several functions are variously affected, both in the degree and character of their derangement; while the various associations of the functional disorder, not to mention the complications to which fever is liable, increase the diversities which it offers almost beyond calculation. We must content ourselves with an account of the more common, striking, and characteristic phenomena, such as are exhibited by fever in its ordinary forms, omitting what is peculiar to the several febrile diseases, until these are treated of individually.

1. *Forming Stage.*—Fever is seldom fully formed at once. Various *premonitory symptoms* often intimate its approach, before it can be said to have commenced. These constitute what is called the *forming stage of fever.* The first symptom is usually a sense of lassitude or weariness, attended with yawning and stretching. The muscles feel as if fatigued, and sometimes sore, as if they had been bruised. There is often an aching sensation in the joints and limbs, with slight pains in the back, and occasional chilliness;

sometimes pain in the head or giddiness, diminished appetite, and even nausea. The patient is apt to be affected with disturbed sleep, mental confusion or debility, and depression of spirits; but not unfrequently complains of nothing but a vague uneasiness, or feeling of discomfort, which he is unable to refer to any particular part, or to any particular cause. These symptoms are exceedingly variable in degree and duration, sometimes continuing for several days, sometimes only for a few hours; and occasionally they are quite wanting. They are usually most protracted in fevers which run a long course, and shortest in those of high action and brief duration; but this is by no means universally true. It will be observed that they are, for the most part, such as indicate derangement in the nervous functions.

2. *Cold stage*, or *Chill.*—The occurrence of the cold stage is the first decided step in the febrile movement. The onset of this stage is sometimes abrupt and striking; the patient passing into it at once from the slight and scarcely appreciable disorder of the preliminary stage, or even from a state of seeming health. Sometimes, on the contrary, the premonitory symptoms are gradually merged in those of the cold stage, so that it is impossible to decide at what point precisely the latter commences; and there is every grade between these two extremes. There is usually at first a greater sensitiveness of the surface to the impression of cold, so that a current of cool air, or the contact of a cool body, produces a sense of chilliness, which runs momentarily through the frame, and then subsides. The feeling of cold, however, soon becomes more permanent, and quite independent of surrounding objects, beginning most commonly in the back, and extending to the limbs and over the body, producing rigors, shivering, chattering of the teeth, and sometimes universal tremors and even shaking, though the patient may be near a fire, or covered with blankets in bed. In general, the sensation of chilliness is attended with a positive reduction of temperature upon the surface, especially in the extremities; but this is not always the case; and instances occur in which the skin feels as warm as in health, or even warmer, to the hand of another person, while the patient is suffering with cold. On the contrary, the sensation is sometimes nearly or quite wanting, while the body feels cold to others, particularly in the extreme parts, as the hands, the feet, the ears, and the tip of the nose.. In some cases, this want of the sensation of cold continues throughout the chill, in others, it lasts but a short time, and the feelings of the patient come into harmony with his real state. The feeling varies in different cases, from a barely perceptible chilliness, to the sensation almost of freezing. The thermometer, placed under the tongue, or in the axilla, is said to be sometimes as low as 92°; while the temperature is much lower in the extremities. (*Thomson on Inflammation.*)

The slight pains of the premonitory stage are increased greatly during the chill; or, if pain has not previously been felt, it now generally takes place in a greater or less degree, occupying chiefly the back and extremities, and not unfrequently affecting the head. The pain in the back and loins is sometimes exceedingly severe, and even excruciating, especially in violent and very dangerous cases, as in malignant smallpox, malignant typhus, and bad cases of yellow fever; and the occurrence of these excessive pains in the back may usually be looked upon as an unfavourable sign. The pains peculiar to this stage are wholly nervous, being unconnected with inflammation. There are usually other evidences also of sensorial derangement. Sensibility is often diminished, and the mental functions impaired; and even delirium occasionally occurs, although this is not common in the chill.

The circulation, which even before the commencement of the cold stage is often languid, now becomes obviously depressed. The pulse is weak, small, often irregular, sometimes more frequent, sometimes less so than in health. The capillary circulation is slow and feeble. The face is pale, the features often shrunk, the skin generally pale and contracted, with the appearance of goose-flesh; and, in very bad cases, the fingers are sometimes shrunk and wrinkled, as after long immersion of the hand in water. There is often a purplish or bluish appearance in the hands and feet, especially about the finger and toe nails, arising from a stagnation of the blood in the capillaries; and this appearance, with a feeling of coldness in the same parts to the hand of the observer, is occasionally the only phenomenon by which the chill, when very slight, is to be recognized.

The respiration is short and somewhat hurried, and, in cases attended with great prostration, is occasionally anxious and laboured; and both the breathing and the pulse are much accelerated by muscular exertion.

Nausea and vomiting often occur during the chill, attended with thirst, and a dryish, clammy state of the mouth and fauces.

The commencement of the cold stage is sometimes marked with drowsiness, which may increase to stupor, and end in a true apoplectic state, dependent upon congestion of the brain. In other cases, immense prostration of nervous energy occurs, with a failure in all the dependent functions. The pulse is exceedingly feeble, thread-like, and scarcely perceptible; the skin cold, pallid, and shrunk; and the sensorial functions almost abolished.

The duration of the chill is very variable, in some cases not exceeding a few minutes, in others extending to hours and even days; and, in malignant diseases, the system not unfrequently fails to rise out of this state of prostration. In these diseases, a doubtful struggle is sometimes maintained, for a considerable time, between the depressing agency and the powers of the system; a partial reaction taking place and then subsiding, to be followed by another equally unsuccessful effort to rally, and this oscillation continuing until the patient at length sinks, or the hot stage is established. The cases, however, are very few, in which, after the lapse of a certain period, the symptoms of depression are not followed by those of excitement. It is not till this event has occurred that fever can be said to be fully formed. Occasionally, the cold stage is altogether wanting.

3. *Hot Stage.*—The symptoms of the chill usually pass by degrees into those of the *hot stage.* The coldness subsides, and is succeeded by a sense of heat, which is at first not uncomfortable, but soon becomes excessive and distressing. It is usually felt first about the face and eyes, and in the breath, then in the trunk, and ultimately in the extremities. Upon the surface it often alternates with the chilliness. If a limb be moved into a cooler spot in the bed, a shivering sensation of cold flashes, as it were, for a moment through the body; and there is often an alternation of heat and cold for some hours before the former becomes permanent. The sensation of heat is not confined to the surface, but extends also to the internal organs. Nor is the sensation delusive. The surface feels hot to the hand of another, and an elevation of temperature is indicated also by the thermometer, which, when placed under the tongue, rises in some instances as high as 107°, though it does not often exceed 105°. (*Thomson on Inflammation.*)

At the same time that the heat increases, the circulation is also accelerated. The character, however, of the vascular reaction varies greatly. Usually, the pulse is full, strong, and quick, as well as frequent; but in some instances, and especially where the fever is sympathetic of inflammation in some highly vital part, it is small, contracted, and tense, or, to use an ordinary expression, corded; while in others, again, it is more feeble than in health, and is readily compressible, indicating that the heart, though irritated, is deficient in power.

The degree of frequency is also exceedingly various, being sometimes little above that of health, but in the great majority of cases somewhere between 90 and 110 in the minute, and occasionally much higher, reaching, in some instances 130, 140, and even 160. As a general rule, its frequency, during the continuance of the irritative action of the heart, is inversely proportionate to the energy of the system; so that it is greatest in fevers attended with deficient vital power, as in typhoid fevers and scarlatina. When the pulse is full and strong, or tense, indicating great energy in the circulating forces, it is seldom or never exceedingly frequent.

Reaction, thus evident in the heart and upon the surface, takes place equally in the brain. The face is flushed, the head painful, the senses usually more acute, and the mental functions disordered. It very seldom happens that symptoms of encephalic excitement are altogether wanting in established fever. In the great majority of cases, there is more or less pain in the head; and this is frequently severe, throbbing violently with every pulsation of the heart, and constituting the greatest source of distress to the patient. But, even when positive pain is absent, there is usually some feeling of uneasiness, a sense of fulness, tension, weight, lightness, or dizziness, attended generally with more or less confusion of thought, often amounting to delirium. The eyes are painfully sensitive to light, and the ears to sound; and both vision and hearing are usually sharpened; though the reverse sometimes happens, especially in relation to hearing, which, in a particular form of fever, is dull from the commencement. This increased sensibility, moreover, disappears in general with the progress of the fever. Taste and smell are impaired, in consequence of the morbid state of the membranes in which they reside. Other symptoms, connected with disorder of the cerebro-spinal axis, are restlessness, disturbed sleep or morbid vigilance, a general and vague uneasiness, pains in the back, limbs, and other parts of the body, all of which are frequently present in fever, and some in a very distressing degree.

The digestive organs are always disordered. The appetite is entirely lost; and there is generally a disgust for food, and for warm drinks. Nausea and vomiting are not unfrequent. There is almost always thirst, which is sometimes insatiable. Cold water and ice are usually very grateful to the patient. A disagreeable taste in the mouth is very common; and the tongue is almost always covered with fur, which is usually at first thin and white, then thickens and becomes yellowish, and sometimes assumes a brown or blackish colour. The end and the edges of the tongue, when not coated, are generally redder than in health. Sometimes the mouth remains quite moist; more commonly it is dryish and clammy; and occasionally it is quite dry, in consequence of a total suspension of the mucous and salivary secretions. In some instances, the gums exude a dark tenacious matter, which adheres to them and to the teeth. The bowels participate in the general disorder of the alimentary mucous membrane, being affected, for the most part, with constipation or diarrhœa; and the discharges are almost always unhealthy, either in colour, odour, or consistence. Constipation is most common, unless when the mucous membrane is inflamed or ulcerated.

The secretions are always deranged in fever. When the disorder is at its height, they are usually deficient. Hence the dry skin, the burning eye, the dry tongue and mouth, the constipated bowels, the scanty and high coloured urine. In other conditions of fever, especially in its decline, or when its violence has so far remitted as to permit the secretory organs to resume their functions, the quantity secreted is often in excess. Hence the copious perspiration, the serous and bilious diarrhœas, and the profuse discharge of urine, which occur under the circumstances mentioned. The character as well as the amount of the secretion is also changed. The breath and perspiration often acquire a disagreeable odour, the urine is changed in colour and consistence, and the bile discharged from the stomach and bowels is seldom quite healthy in appearance.

The respiration, which in the primary stage is short and hurried, becomes more free when the fever is fully developed, but still remains frequent; and there is very often a short, dry cough.

All the symptoms enumerated are exceedingly modified in the various febrile affections, and are often complicated with others not essentially belonging to fever itself; as with those resulting from the incidental inflammation of different organs, from peculiar changes induced in the vital energies and the condition of the blood by the nature of the cause, and from certain organic derangements also referrible to peculiarity of cause, such as the eruption in the exanthematous fevers, and the disease of the intestinal mucous follicles in enteric or typhoid fever. An account, however, of these complications belongs to the department of special diseases. Here we have only to consider what is incident to the febrile movement in general.

The duration of fever is not less variable than its symptoms. It is impossible to say what exactly determines this duration. The nature of the cause, its intensity, the duration of its action, and the predispositions of the system, all, no doubt, have their influence. Sometimes fever ceases after a few hours, sometimes continues for days, weeks, or months. The diversities in its course will engage our attention directly; at present, it is best to complete a view of the affection by giving the characteristic phenomena of its decline.

4. *Declining Stage.*—The term *crisis* has been applied to that period of fever at which it either takes a favourable change and begins to decline, or, failing in this result, goes on to a fatal issue. In some forms of fever, as in the exanthemata, there appears to be a disposition to end at certain fixed periods, a certain number of days, for instance, from their commencement; and these periods have been called *critical days.* But, in regard to fever in general, irrespective of the cause producing it, there is no reason to suppose that this disposition exists. It may, in a great many cases, be arrested by proper means, at any point of its progress; and, even if left to itself, will often run a course corresponding with the intensity of the cause, the previous state of the system, or the circumstances in which the system may be placed. Thus, the fever from a wound will cease when the inflammation of the wound is subdued. The fever from reaction after cold may cease in a few hours, if not sustained by favouring predispositions, or injudicious management; while, under opposite circumstances, it may run on for days.

When fever begins to decline, the change is often marked by the occurrence of some spontaneous evacuation, such as profuse perspiration, increased urine, bilious or serous discharges from the bowels, or hemorrhage. Hence, these have been called *critical discharges.* Occasionally, along with some one of these discharges, or in place of them, one or more abscesses form in various parts of the body, often containing large quantities of pus. These have been called *critical abscesses.* It has been conjectured that these evacuations were the means by which nature effected the cure of the complaint; and the idea at one time extensively prevailed, that, through their instrumentality, offensive matters, which served to sustain the fever, were eliminated from the system. Without attempting here to confute this hypothetical notion, it is sufficient to say that the discharges are the necessary results of a certain grade of irritation in the organs, and, if they serve to relieve the disorder in which they originate, it is only one of the numerous instances in which nature has contrived to make noxious influences subservient to their own removal. By far the most frequent of the evacuations which attend the decline of fever is perspiration.

Along with the relaxation of skin, the *tongue*, if before dry, begins to moisten, in consequence of the returning secretion of mucus and saliva; and most of the secretions, which have before been locked up, now make their appearance in greater or less degree. The fur on the tongue also begins to be removed, and the surface of that organ to assume the healthy colour. This is one of the best evidences of the commencing decline of fever. The fur generally disappears first from the tip and edges of the tongue, and gradually recedes till wholly removed; but the process is often not completed for some time after convalescence has been established. Sometimes the coat of fur is thrown off in a different way. It is loosened by some organic change in the surface of the tongue, and large flakes of it separate at once, leaving the surface often red, smooth, and glossy. This also may be considered as a favourable sign in fever, though a protracted convalescence may often be anticipated. The tongue in these cases, gradually becomes paler, and resumes its papillary appearance; but time is required for the completion of the process; and it is highly probable that some analogous condition of the gastro-intestinal mucous membrane exists, preventing a speedy return to health, though the proper disease may have disappeared.

Simultaneously with the symptoms of amendment above mentioned, the *pulse* becomes less frequent, and, if previously hard and strong, is softened. But it often happens that the frequency of pulse persists, to a certain degree, through the period of convalescence; and the slightest causes will, in many cases, throw the heart into tumultuous action. It is important that this should not be mistaken for the result of the continuance of fever. It arises from debility, and ceases when the organs have regained their normal state.

The thirst and disinclination for food subside with the other symptoms, and the patient gradually recovers his appetite, which often becomes inconveniently exacting. Sometimes, however, atony of the stomach follows the subsidence of the febrile derangement of the organ, and the patient requires the cautious use of tonics to invigorate his appetite and digestion.

Fever may terminate fatally at any period of its course. Even in the cold stage, the system is sometimes depressed by the violence of the cause below the point of reaction, and the patient dies of pure prostration. In the same stage, it is thought that death occasionally occurs from congestion of the internal organs, especially of the brain, by the retreat of the blood from the surface, and the inability of the heart to transmit it through the system. In the violence of febrile reaction, fatal effects may ensue from excessive arterial congestion of the same organs, or from hemorrhage. But, usually, fever terminates fatally only after a considerable duration; and then, death, in the great majority of cases, depends upon derangement of the blood, or disorganization of some vital organ or organs, consequent upon inflammations which have arisen during the course of the disease. Sometimes, however, the patient sinks from debility, resulting either from the direct influence of the original cause, from some profuse discharge by hemorrhage or secretion, or from the collapse which follows excessive excitement.

2. *Duration and Course of Fever.*

Fever runs a very diversified and uncertain course. When produced by causes merely calculated to excite the functions, without any peculiarity of influence, and ceasing to operate immediately after having occasioned a morbid impression, it is altogether irregular in its duration, lasting for a few hours, or for many days, according to the previous condition of the system, or the circumstances under which it may be placed at the time. When produced by pre-existing morbid states of particular organs, as by inflammation, it continues only so long as the local affection retains a certain degree of activity; unless, indeed, there may be some latent cause which the disturbance of system calls into action; as, for example, when an individual has been exposed to marsh miasmata, and escapes their effects until inflammation, produced by cold or other causes, excites a fever which brings the latent poison into play. The fever will, under such circumstances, continue altogether independently of the inflammation in which it originated.

There are other cases of fever, in which, from the peculiar influence of the cause, the disease exhibits a disposition to cease at certain successive periods, and at length gives way at one of these periods, when the cause has lost a certain degree of its activity, or the system a certain amount of its susceptibility. Such are the miasmatic fevers. These may often be interrupted by taking advantage of their periodical disposition to relax.

But there are also fevers which run a determinate course, which no means in our power are sufficient to arrest, though the physician may often obviate their injurious effects, and conduct them to a safe termination. Of these, some continue a longer or shorter period, according to influences which we cannot fully appreciate; as the enteric or typhoid fever, which varies much in its duration, though, in cases which recover, it very seldom continues a shorter period than two weeks. Others, again, run a definite or nearly definite course, terminating in general, when they end favourably, and are not complicated, in a certain number of days, as the smallpox, measles, &c.

In relation to the course of fever, there are some points of great importance. Occasionally, we observe the febrile movement running through its different stages of chill, reaction, and decline, in less than a single day, perhaps in a few hours, and then ceasing altogether. In such cases, the disease has received the name of *ephemera.* Very often, however, after an interval of one, two, or three days, the fever recurs, and, having run the same course as before, again recurs at the same interval, and so on indefinitely. In this case, it is said to be *intermittent* or *periodical;* the period occupied by the febrile movement is called the *paroxysm,* and the intervening space, in which there is a total absence of fever, the *intermission* or *apyrexia;* while the term *interval* is applied to the whole time, from the commencement of a particular paroxysm to that of the one preceding or succeeding it. The variable length of this interval has given origin to different designations of intermittent fever, as the quotidian, tertian, &c., according to its length. (See *Intermittent Fever.*) This habit of recurring at one interval rather than another is called the *type* of the fever, though the term is sometimes extended to express other peculiarities of form or character. All febrile diseases are not susceptible of the intermittent character; nor are fevers the only intermittent diseases. Perhaps all merely functional disease is capable of becoming intermittent. The cause of periodicity, I shall endeavour to explain in another place. This quality of disease is highly important in a therapeutical point of view. The circumstance of periodicity does not give to fever the character of a peculiar disease, differing essentially from all other forms. Fever arising from any cause incapable of sustaining a constant disturbance in the functions, and yet not ceasing to act altogether with the production of the first paroxysm, may assume the form of an intermittent. Thus, irritation in the urethra has produced an attack of intermittent fever; and hectic fever, resulting from steady irritation in a debilitated system, approaches to it closely in character, and in some cases can scarcely be distinguished. In the great majority of instances, however, in which intermittent fever occurs, it is of miasmatic origin.

Fever often exhibits a tendency to the paroxysmal form, without being intermittent. The febrile action, after being fully established, subsides for a time, and then increases and again subsides, observing stated periods of augmentation and decline, but not disappearing entirely. In these cases, the period of increased excitement is called the *exacerbation*, that of diminished excitement, the *remission;* and the fever is said to be *remittent.* Sometimes, the exacerbations and remissions are strongly marked; the former, like the paroxysm of an intermittent, being ushered in with a chill, and terminating with perspiration, and the latter, exhibiting a very moderate grade of febrile action. Sometimes the exacerbation takes place without a chill, but subsides with perspiration, and *vice versâ;* and very frequently there is neither chill nor perspiration, the fever simply rising and falling, without any peculiar attendant phenomena. As a general rule, the nearer the remission approaches to a perfect intermission, the more apt is the exacerbation to exhibit the cold, the hot, and the sweating stages, and the more strongly marked are the chill and perspiration. The exacerbation most commonly occurs every day, sometimes every other day, and occasionally twice daily. (See *Remittent Fever.*)

Fever which runs a steady course, without remission or intermission, is said to be *continued.* But, in the strictest sense of the word, there are probably no continued fevers of any considerable duration. A fever may possibly proceed evenly, or with a constant increase, for two or three days; but even this is not common; and, beyond the last-mentioned period, a continuance without any relaxation is scarcely compatible with physiological laws. In almost all fevers, from whatever cause they may arise, whether idiopathic or symptomatic, there are occasional exacerbations and remissions, usually occurring daily, sometimes even twice a-day; although these are often very slight, and very irregular in their recurrence. But, as there is a decided distinction between different febrile diseases in these respects, some offering marked exacerbations and remissions, occurring at somewhat regular intervals, approaching more or less closely to intermittents, and others being less strongly marked, and less regular, it seems proper to recognize the difference by the name; and, therefore, the term *remittent* might with propriety be restricted to the former, and the term *continued* applied to the latter class.

3. *Grade of Fever.*

Fever varies in degree, from the mildest state, in which the febrile symptoms are but just discoverable, up to the most severe and deadly; but there is another important distinction, which has reference to the grade of the vital forces. Two very striking varieties arise from this origin. In one, the susceptibilities and energies of the system are unimpaired, or even perhaps elevated above the ordinary standard. The influence of the causes of irritation is, therefore, felt keenly, and responded to vigorously. The febrile reaction is promptly established; the heart contracts energetically; the pulse is full and bounding, or small and contracted, but always firm; heat is largely developed; the face is flushed; the head painful; delirium, when present, is of the active character; the tongue is usually moist; in short, the symptoms are in general those of high and vigorous excitement. Under these circumstances, the fever has been called *inflammatory;* partly, because a certain analogy has been observed between this condition of the system and the local condition existing in inflammation, and partly, because the fever, sympathetic of active inflammation, is usually more or less of this character. After Cullen, it is sometimes called *synocha;* but it should be understood that this is not a distinct disease, or variety of fever, but merely a particular state which fever, arising from various causes, and connected with various diseases, may assume in consequence of the existing condition of the system.

In the other condition of fever alluded to, the grade of the vital forces is low. There may be susceptibility, but there is a want of energy in the system. However powerful may be the exciting cause, however disturbing its agency, though great agitation and disorder may be produced, yet all the resulting movements have the taint of weakness. In this case, the reaction is often slow, and is sometimes established with great difficulty. There is occasionally an apparent struggle between the depressing influences and the powers of the system, an alternation of chill and febrile excitement, for some time before the latter becomes continuous; and, in some instances, reaction never takes place, the patient dying in the cold stage. When the fever has been fully formed, the heart beats rapidly, but not strongly. The pulse is often very frequent, much more so than is usual in the former variety; but it is also very feeble, yielding readily to pressure, and sometimes, when rather full, imparting a sensation to the finger almost as if the vessel were filled with air. Though the heat of the surface may be greatly increased, yet it is uncertain, frequently alternating with coolness; or one part of the body is cold while another is hot; and the excitement is apt to give way to prostration or collapse. The tongue is generally dryish or quite dry, and covered with a dark fur; and sordes collect about the teeth. The sensorial functions are always impaired. Stupor and coma, or delirium, are common; and the delirium is usually of a low muttering kind, indicating rather an enfeebled state of the brain than over excitement. This condition of fever is called *typhous*, and sometimes *asthenic*, or by the French, *adynamic*. It is not essentially a distinct disease; but may occur in any febrile affection, even though resulting from inflammation, if the vital forces are greatly reduced. Thus, we occasionally have this condition of fever, not only in the diseases commonly known as typhus and typhoid fevers, but also in intermittents, in bilious remittents, in the various exanthemata, as smallpox and scarlatina, and in symptomatic fevers, as pneumonia and dysentery. Care should be taken to distinguish the term *typhous*, as applied to this state of fever, from the term *typhus*, which is employed to designate a particular febrile complaint, having peculiar causes and a distinct course.

Besides the two grades of fever above described, there are often intermediate or mixed conditions, of which it is difficult to say to which they belong. Very often, the fever is *inflammatory* at the beginning, and *typhous* near the close. To this state of fever the name of *synochus* was given by Cullen, who has been followed by most English authors in his nomenclature. It is possible also for fever to be attended with great debility and even prostration, without the peculiar phenomena which are considered characteristics of the typhous state; as stupor, low delirium, dry tongue, sordes about the teeth, a dark hue of the surface, &c. It is probable that the difference depends on the state of the blood, a special derangement of which, there is every reason to believe, gives rise to the proper typhous symptoms.

The state of the vital forces on which these different grades depend may pre-exist, or may be induced by the cause or causes of the fever itself. Whatever tends to increase the powers of the system predisposes to the inflammatory condition of fever; whatever diminishes these powers, to the adynamic. Thus, vigorous exercise, pure air, a cheerful mind, a good appetite, and a full diet, place the system in a condition, partly through their invigorating influence upon the solids, partly by the rich fibrinous bright-red blood which they produce, to assume the inflammatory grade of fever, when exposed to causes capable of inducing that affection. On the contrary, confinement, impure air, mental dejection, bad living, and the depressing influence of long-continued cold, of sulphuretted hydrogen, and of other sedative agents, produce a general deterioration of health, a languor in all the vital functions, and an impoverished or depraved condition of the blood, which very generally give to fever, by whatever cause induced, the low, asthenic, or typhous character.* But it also not unfrequently happens that the exciting cause of the fever is itself of a depressing nature, in relation to some at least of the vital functions, and that a typhous condition of the system, as well as the febrile movement, results directly from its operation. Such, beyond all doubt, is the case with the poisonous effluvia which cause the proper typhus fever, and, to a certain extent, also, that which produces scarlatina. It is not improbable that these depressing agents operate, in some measure, in producing the tendency to prostration, by destroying the healthy character of the blood. At least, it is certain that the blood is often very much depraved in low cases of fever, and must contribute to the prostration by its unfitness for supporting the vital actions; although it is difficult to say how far its peculiarity depends on the direct action of the cause, and how far upon the deranged actions of the various organs which the cause has put into movement.

Before leaving this branch of the subject, I wish again to impress upon the reader that the terms *inflammatory*, *synochous*, and *typhous*, as applied to fever, are merely expressive of different states of this affection, and not of distinct febrile diseases.

4. *Relation of Fever to Inflammation.*

In fevers of every type and every grade, inflammation of one or more organs is very often observed, although, as may be inferred from what has been already said, the author does not believe that there is any necessary connexion between fever and that affection; and the fact appears to be, that the former frequently runs its whole course, without any positive proof, or even any strong probability, of the existence of the latter. Sometimes, the association of inflammation with fever is purely accidental; as, for example, when a febrile complaint is occasioned by some peculiar cause, in persons previously affected with inflammation; or when the latter affection is produced by violence, or other extraneous cause, during the progress of fever. In all cases not purely accidental, inflammation co-existing with fever may be considered as bearing towards it one of these three relations. It is either 1. the effect of the fever, or 2. the direct result of the same cause that produces the fever, or 3. the cause of the fever.

1. That inflammation should result from the febrile movement is nothing more than might be expected from a knowledge of the causes and characters of these two disorders. In the universal derangement of the functions in fever, many of them being in a state of over-excitement or irritation; in the consti-

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* Thus, it happened to the author to attend, on one occasion, in a large establishment (the Institution for the Deaf and Dumb in Philadelphia), when the family were exposed to the effluvia arising from the contents of a privy which had flowed into the cellar, in consequence of the rupture of a wall which had confined them. Inflammation of the lungs was at the time prevalent in the city, and not less than thirty members of the family were attacked with a fever, exhibiting evidences of bronchial or pneumonic inflammation. The fact which is particularly interesting at present is, that a large proportion of these exhibited typhous symptoms; and in very few, if any, was copious depletion well borne. This result was ascribed to the depressing influence of the exhalations, which predisposed the system to the low form of fever, even when attacked by inflammatory disease.

tution of the blood, which is often highly stimulating; and in the increased rapidity of the circulation; not to mention the irregular distribution of the nervous influence; we have those very conditions which are most favourable to the developement of inflammation. How easy must it be, under these circumstances, for the excitement in particular parts to pass the boundary which separates mere irritation from inflammatory action! It is not, therefore, surprising that fevers, of any considerable duration, should be almost always attended with inflammation of one or more organs, though, in the commencement, wholly free from any such complication.

2. The causes which produce the general derangement of function called fever, may also operate on particular organs, so as to produce inflammation; and the two conditions may thus be associated from the commencement. Thus, cold is believed to be capable of exciting the febrile movement without inflammation, and it is certainly capable of producing the latter without the former. A fair inference is, that it may produce the two, in some instances, conjointly. There is reason to believe that it actually does so. At least, it occasionally happens, in the phlegmasiæ, that the fever and inflammation correspond so closely in their time of commencement that it is difficult to conceive that one is the effect of the other. The patient has a chill, febrile reaction occurs, and, at the same time, the phenomena of inflammation. The two probably depend upon the same cause. In the exanthematous diseases, in which the characteristic eruption comes on at certain periods after the commencement of the complaint, it very probably results from the immediate influence of the cause. So also with the sore throat of scarlatina, and the catarrhal affection of measles, which, as they are certainly not the cause of the fever, and, commencing almost simultaneously, and sometimes even previously, can scarcely be considered as its effects, must be ascribed to the same source as the fever itself.

3. The fact that inflammation produces fever is so well known as to require no comment in this place. The fever attending wounds, and all the phlegmasiæ are examples.

From all these causes it happens that inflammation is an almost invariable accompaniment of protracted fever; and the association is so frequent as to have led to the belief, on the part of many pathologists, that there is no such thing as an independent febrile movement, and that all fevers are in fact inflammations, the general disorder being nothing more than the effect of the local disease. Upon this point I shall have more to say, when discussing the different opinions upon the nature of fever. The reader is already aware that the opinion is not that of the author.

5. *Causes of Fever.*

Any cause capable of producing a powerful or very general impression on the system, either of an excitant or depressing character, is probably capable of producing fever. The various organs of the system are so connected by sympathy, or by mutual dependence, that they may be all brought into derangement by a certain amount of disease in one, or in any number of them. A slight affection, of small extent, is generally insufficient to rouse these sympathies, and therefore continues local. But, if the affection involve several organs, even though slight in degree, it may extend to the whole, and give rise to general disorder. Any cause, therefore, capable of inducing irritation in any considerable number of organs, or over any considerable portion of the body, either by a direct impression, or by the reaction which follows depression, or by the super-excitement in certain parts resulting from depression in others, may occasion universal derangement, and consequently fever. It has before been stated that a slight disorder of the functions, vanishing almost as soon as it occurs, without leaving injurious results behind it, can scarcely be accounted disease. This is true of the whole as well as of a part; and a general derangement of the system, in order to constitute fever, must have a certain duration. The cause, therefore, to be entitled to that name, must not be quite fugitive in its action. It follows, from what has been said, that all the causes of irritation and depression, not quite local or circumscribed in their influence, may prove causes of fever. (See *Irritation* and *Depression.*)

When inflammation becomes established, it continues for a certain length of time, and runs its course independently of its cause. It is the inflammation, therefore, and not the agent which produced the inflammation, that must be considered as the cause of the resulting fever. In northern latitudes, there is certainly no cause so operative as this. The fevers from inflammation probably exceed in number those which arise from all other causes put together. How it is that the organic derangement of an inflamed part is so much more provocative of fever than the functional disorder of the same part, in a state of irritation, must be explained chiefly by reference to the greater intensity of the former affection, and its consequently more powerful appeal to the sympathies; but it is probable, also, that the change in the mass of blood, which acquires an increased proportion of fibrin during inflammation, may have something to do with the result.

The facility with which irritation or inflammation may produce fever depends much upon the predisposition of the system. Sometimes, a slight degree of either will give rise to the febrile movement; in other instances, the system scarcely seems to feel them when extensive or intense. It is obvious, therefore, that some conditions of system in apparent health must be favourable, and others unfavourable to fever. In what these conditions consist is not well understood. They probably sometimes depend upon an unknown state of the nervous system, rendering the sympathies more or less active than usual; sometimes on the condition of the blood, which may in one case be more stimulant, and in the other less so than in perfect health. It is highly probable that the retention of various recrementitious substances in the blood may give to that fluid an irritating character, which may greatly favour the influence of some additional irritation, thus constituting a strong predisposition to fever; and it is not impossible that such an accumulation of unhealthy matters in the blood-vessels may of itself produce fever. But all this is more or less conjectural. We are in want of facts upon which to found a demonstration. There is, however, one well-ascertained condition, which frequently serves as the predisposition to febrile attacks. An irritation or inflammation is occasionally quite latent, insufficient to involve the system, and scarcely even attracting the serious attention of the patient. It may be slight in degree, or so chronic that the system has gradually become accustomed to its presence, and ceased to feel it. In this condition, for example, may be the stomach in intemperate persons, the liver in those exposed to great and continued heat, and the brain in those much agitated by perplexing or exciting thoughts. A slight additional cause is now sufficient to awaken fever; and it is not improbable that many cases of this affection, the origin of which appears obscure, might be traced, if accurately examined, to this source.

In relation to fevers arising from obvious sources of irritation, direct or indirect, or from inflammation, it is worthy of observation that they in general continue only during the influence of their cause, or quickly subside when the cause has ceased to act. In some instances, it is possible that a fever, produced and long sustained by irritation, may continue a certain length of time, through the influence of habit, after the original cause has disappeared; but the general rule is as above stated. Thus, a fever resulting from the reaction after exposure, under certain circumstances, to cold, subsides very quickly, unless sustained by inflammation simultaneously produced; and the constitutional symptoms in pleurisy, pneumonia, gastritis, &c., disappear when the inflammation of the pleura, lungs, and stomach respectively is subdued. It is probable that what is called ephemeral fever thus has its origin in some transitory irritation.

But there are numerous fevers, which, when once produced, run a certain course often quite protracted, and altogether independent of any renewed application of the cause. Whether the cause, in these cases, sets a certain concatenation of morbid actions into motion, which must go on like those of the clock or watch till they have run down; or whether the morbific agent is absorbed, and continues to exercise its injurious influence until finally eliminated by the efforts of the system; or whether this same agent has the power, either of assimilating, in some degree, to its own nature, by a sort of chemical action, the blood with which it circulates, or of so affecting the solids as to enable them to produce, out of the materials upon which they act, a similar substance, capable of continuing the primary impression until the system has become thoroughly accustomed to the new influence, as may be supposed to be the case in the contagious fevers; all these are questions which have been much agitated, but never satisfactorily solved. The causes of such fevers may all be arranged, so far as they are known, under the heads of *miasmata, contagion*, and *epidemic influence*. Our knowledge in relation to the true nature of these causes is exceedingly vague and uncertain, and the real agents have never been isolated; but their origin, their modes of action, and the laws which regulate them, have been industriously investigated, and are to a certain extent known. As I shall have occasion to consider them particularly, in the chapter upon the general causes of disease, it is unnecessary to dwell upon them here.

6. *Theories of Fever.*

Upon a subject so important as fever, which has occupied so much of the attention of writers on medicine, in all ages, it is deemed proper, even in an elementary work like the present, to give a sketch of the most prominent opinions which have been entertained in relation to it, especially as in these opinions are involved, for the most part, the general medical doctrines of the times when they prevailed.

Humoral Pathology.—The first hypothesis broached in relation to fever, and that which continued longest to command the faith of the medical world, ascribed it to a disordered condition of the fluids of the body. Hippocrates considered increased heat to be the essence of fever, and its proximate cause to be a superabundance of the bile, the black bile (atrabilis), the phlegm, or the blood. Galen had the same notion in relation to heat, and, carefully distinguishing the phlegmasiæ or inflammations from fevers properly so called, referred the latter to an alteration or putridity of the fluids; the varieties being produced severally by the bile, the black bile, the phlegm, and the blood. The idea also appears to have been entertained by the ancients, that the commotion in the system had the object of expelling the superabundant or morbid humours, or of rendering them harmless. There were, of course, differences of opinion among ancient authors; and Celsus seems to have been not far from the truth, in treating of fever simply as a disease of the whole body. The Greek writers were followed by the Arabians; and, upon the revival of learn-ing, were naturally the fountain from which the physicians of Europe drew their opinions.

The discovery of the circulation of the blood induced some modification in these opinions, without essentially changing them. It was now understood that the bile and phlegm were merely secretions from the blood; and this fluid came to be considered as the chief, if not the exclusive, source of mischief. Not only in the case of fevers, but of all other diseases, it was supposed that the blood becomes contaminated or depraved, either by the reception of noxious substances from without, or in consequence of changes going on within the body; that the system is excited by the presence of these impurities either to direct efforts for their expulsion, or to a course of elaborative action, so as to fit them for expulsion; and that, in the language of Sydenham, "a disease is no more than a vigorous effort of nature to throw off the morbific matter, and thus recover the patient." This is the sum and substance of the humoral pathology. According to this view, fever is only a violent effort of the system to rid itself of noxious matter; and the sweats, bilious discharges, turbid urine, suppurations, and cutaneous eruptions, which so often attend fever, are merely different means by which this matter is expelled As to the nature of the morbific matter, and its mode of production, there was much difference of opinion. Chemical discovery was naturally brought to the aid of pathology; and the notions of an acid, alkaline, or earthy contamination, of the contest between acid and alkali, and of fermentation, were prominent among the almost infinite multitude of speculations. The idea of the necessity of a certain *concoction*, by which the morbific matter was to be prepared for expulsion, was perhaps the most practically injurious of these theoretical notions; as it led to the practice, under the idea that the febrile movement was necessary to the concocting process, of employing means rather to increase than to moderate that movement. Hence the hot drinks and close confinement, which were at one time so much used, and so fatal, in the treatment of smallpox and other febrile diseases.

Among the modifications of opinion connected with the humoral origin of fever were those of Boerhaave and Stahl. The former, while he admitted the influence of chemical changes in the fluids, ascribed fever not so much to contamination of the blood as to its greater thickness or viscidity, which caused it to stagnate in the extreme vessels, and thus brought on the cold stage of fevers, followed by all its train of excessive action. Stahl, conceiving that fever consisted in a plethoric or depraved condition of the fluids, imagined the existence of a superintending rational principle, called variously *autocrateia*, *anima medica*, and *vis medicatrix naturæ*, which, in this as in all other diseases, watched over and directed the movements of the system with a view to its preservation; so that fever, instead of being a morbid condition, was in fact a series of actions, under the guidance of this principle, for the removal of the real cause of offence. This theory led to an expectant practice, which contented itself with observing the efforts of nature, and taking care that nothing interfered with her objects. The theories both of Stahl and Boerhaave had a wide prevalence in the schools of Europe, and made an impression on professional opinion which has scarcely yet disappeared.

Nervous Theories.—All the opinions hitherto mentioned were upon the basis of the humoral pathology. This remained undisputed till the times of Hoffmann and Cullen. To the former belongs the credit of first leading the attention from the fluids to the solid structure, as the seat of the disease.. Hoffmann sought, in the nervous system, the source of the mischief; and it is wonderful, considering the character of the symptoms, that the idea did not sooner occur to theorists. He believed the first step, in the establishment of fever, to be spasm of the capillaries; and the heat of skin and arterial excitement which follow, he considered as the mere reaction of the system, necessary to overcome this spasm. It was Cullen, however, who gave consistence and popularity to the new opinions, and completely overturned the old doctrines of humoralism in the estimation of the profession. The hypothesis of that celebrated teacher was, that, under the influence of some sedative agency upon the nervous system, the energy of the brain is diminished, and all the functions consequently debilitated, especially those of the extreme vessels; that, from the nature of the animal economy, and, probably, through the instrumentality of the vis medicatrix naturæ, a spasmodic state of the extreme vessels occurs in connexion with the cold stage; that by this a degree of irritation is extended to the heart and large arteries, in which increased action is induced, constituting the hot stage; and that finally, through this excitement, energy is restored to the brain, and extended to the extreme vessels, thus overcoming the spasm of the capillaries, and allowing the excretion of sweat to take place, together with other evidences of relaxation. Cullen denied that any pre-existing morbid condition of the blood was the cause of fever, though he admitted that a change of the fluids occurred during the course of the affection, and as one of its effects; an opinion which had been previously advanced by Baglivi.

Though the explanation of Cullen is greatly in advance of the old humoralism, it is obviously altogether hypothetical, and in some of its parts contradictory to facts. The first step in the formation of fever is, probably, in general, as he maintains, a state of depression, exhibiting evidences of a sedative influence upon the nervous system; but all the rest of the theory is pure assumption. Leaving out of view the fanciful notion of the vis medicatrix naturæ, there is no proof whatever of the existence of spasm of the extreme vessels. On the contrary, in the cold stage, they are in a state of collapse from their inability to receive and circulate the blood, and in the hot stage, though the secretory pores appear to be closed, the vessels themselves are dilated, as is obvious from the fulness and redness of the surface. There is no proof that spasm of the capillaries, even admitting its existence, is the cause of the febrile reaction of the heart and larger vessels; nor that this reaction produces relaxation of the capillaries. It is not even true that symptoms of depression uniformly usher in the febrile movement, nor that the cold stage is the necessary antecedent of all that follows. Fever sometimes begins without obvious depression, and without chill; the system being at once introduced into the state of arterial excitement. A general theory cannot be true which does not embrace all the particular cases.

Not to speak of the theory of Brown, the contemporary and rival of Cullen, who considered fever, as all other diseases, to be nothing more than the effect of excessive or deficient excitement, the former constituting a state of indirect; the latter of direct debility, it will be proper to notice, in a few words, the doctrine of Dr. Darwin, which, embracing the two prominent principles of Dr. Brown, superadds a third equally essential, and explains, with much plausibility, many of the phenomena of fever. In the following explanation, I shall avoid the peculiar phraseology of Dr. Darwin, and employ terms with the signification of which the reader is already familiar. The principles alluded to are, 1. that all excitement of the organs is followed by a proportionate diminution of their power, or exhaustion; 2. that rest, or abstraction of the usual stimuli, renders the organs more susceptible to the subsequent action of the stimuli; and, 3. that the functions of different organs are so associated, that an increase or diminution in one is followed either by a similar change in another, by what Dr. Darwin calls *direct sympathy*, or by a reverse change, the increase of one being followed by a diminution, and the diminution by an increase of another, by what he denominates *reverse sympathy*. These principles are, in the main, correct, and are very extensively applicable in the explanation of morbid phenomena. If the first proposition be modified by the substitution of over-excitement for excitement simply, and if, in the third, the effect which he considers as resulting from reverse sympathy, be ascribed to revulsion, or to mere dependence of function, as when excitement in one organ embarrasses its operations, and thus impedes the action of some dependent organ, the principles stated will correspond with those which have been already inculcated in this work, and for the developement of which much is due to the authors mentioned. To apply the principles—in the cold stage, there is an abstraction of a certain amount of the ordinary stimulus, and consequently an increase of susceptibility in certain parts of the system, so that, upon the re-application of the stimulus, those parts are excited into excessive action, which, combined with the various derangements that take place through the influence of the sympathies, constitutes fever; and this is complicated by the results depending on the various nature and application of the morbid cause, whether it consists in the withdrawal of the healthy stimuli, in which case the debility is direct, or upon the application of stimuli in excess, in which case there is indirect debility, and whether the morbid impression is made especially upon one organ, as the stomach, upon another, as the brain, or upon several simultaneously. Now, if, in addition to the above principles, we admit the positively depressing influence of certain morbid agents, and the reactions which follow their application, which is but an extension of the second principle above mentioned, we shall have the means of explaining a great many of the phenomena of febrile diseases; though it must be confessed that there are many difficulties which remain unsolved by this hypothesis.

Theories of Local Origin.—Hitherto, all writers had recognized the existence of fever as a general disease, independent of any local lesion; while it was also admitted to arise frequently from inflammation of particular parts of the body. In the former case, it was called *idiopathic* or *essential*, in the latter *symptomatic*. It was reserved for the present century to dispute this position. It is true that Pinel considered each variety of fever to be connected essentially with some local disorder, as bilious fever with disease of the digestive organs, nervous fever with disease of the brain, &c.; but he did not deny the essential nature of the fever itself. Clutterbuck, who published, in 1807, his "*Inquiry into the Seat and Nature of Fever,*" was probably the first author who distinctly denied the existence of idiopathic or essential fevers, and asserted the uniform dependence of all fevers upon local inflammation. Those which had hitherto been considered as idiopathic he maintained to be nothing more than inflammation of the brain, and accordingly proposed for them the name of *encephalitis*. He supported his hypothesis by the arguments, that the brain is always affected in these fevers, as proved by the symptoms, and the appearances frequently presented after death, and that the affection is identical in its phenomena, its mode of cure, and the structural lesions it leaves behind, with palpable and acknowledged phrenitis, or inflammation of the brain. Dr. Clutterbuck's views, however, made little impression, and scarcely indeed attracted general attention, until brought forward in contradiction to the claims of a more celebrated author to originality in the denial of the existence of idiopathic or essential fevers.*

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* Since the publication of the first edition of this work, I have seen a statement by Professor Giacomini, in a biographical notice of Tommasini of Parma, to the effect, that

Perhaps no individual, since the days of Cullen, has produced a greater impression on medical sentiment, all over the civilized world, and no one at any time has exercised a greater influence, in his own particular country, over the opinions, the practice, and the spirit of his profession, than Broussais. It is true that his theory of disease in general, and of fever in particular, is at present admitted in its full extent by very few; but it cannot be denied that he very much modified previous opinion, that he awakened a new spirit, and led the way in a new line of investigation, that he almost revolutionized the formerly inefficient therapeutics of his country, and has been in these various ways of incalculable service to medicine. It was, I believe, in 1816, that Broussais announced his doctrine of fever. He agreed with Clutterbuck in denying wholly the existence of essential fever, but differed from him in ascribing all those fevers, previously denominated idiopathic, to inflammation of the mucous membrane of the stomach, or that conjointly of the stomach and bowels. In other words, these fevers, according to Broussais, are *gastritis* or *gastro-enteritis*. Indeed, he appears to have considered every case of disease correspondent with our notion of fever, whether among those formerly classed as idiopathic, or among the symptomatic, to be, if not gastro-enteritis, at least complicated with that affection. Of traumatic fever he expressly states that it is gastro-enteritis, excited by the inflammation of the wound, the irritation being transmitted from the wound to the brain, and thence reflected to the gastro-intestinal mucous membrane. Fever, in the abstract, he defines to be increased action of the heart, and increased heat of skin, producing painful sensation. These are only constituent parts, and not the whole of what we mean by the term fever; but the observations which follow, if applicable to a part of the affection, are still more so to the whole. Inflammation of a part, he observes, when it extends beyond its primary seat, sends irritation to the brain, which reflects it to all the organs with which it is in communication, and consequently to the heart. When the irritation thus transmitted is sufficiently violent to produce fever, it is a grade of inflammation. But, when inflammation is sufficiently intense to produce excitement of the heart, it is also sufficiently so to be transmitted to the stomach; consequently the stomach is inflamed in every case of fever. If, therefore, gastritis be not at the basis of every symptomatic fever, it is at least a uniform attendant.

Another of the theories which maintain the local origin of fever is that of Bouillaud, who considers the affection as symptomatic of irritation or general inflammation of the circulatory system, and peculiar forms of it as arising from its complication with inflammation of other structures, as of the alimentary canal, and cerebro-spinal system, with an altered condition of the blood, &c.

Others again, of this school, content themselves with ascribing fever to local inflammation, without attempting to confine the inflammation essentially to any particular organ.

Eclectic Theories.—The impression produced on general medical sentiment by the zeal of Broussais and his disciples gradually faded; and there are at present few pathologists who consider fever in all cases symptomatic of inflammation. Since his time, there has been no doctrine of fever which can be said to have had a general prevalence. Each individual has the grounds before him, and judges for himself; and probably most persons, seeing a little

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this celebrated Italian physician, in a work on fever published in 1805, put forth the doctrine of the essential dependence of fever upon inflammation, thus preceding both Clutterbuck and Broussais. "Tommasini," says his biographer, "placed the seat of fever, according to the symptoms, in a phlogosis of this or that viscus, and frequently even in a diffuse phlogosis of the entire sanguiferous system." (*Medico-Chirurg. Rev.*, *N. S.*, vi. 273.)—*Note to the second edition.*

truth and some error in every exclusive hypothesis, have selected a portion from each, and formed a sort of composite opinion, of which even the old gothic doctrine of the humoral pathologists constitutes a part. Among the views recently put forth, are those of Dr. Southwood Smith, who maintains that fever is idiopathic, that it consists invariably and essentially of certain derangements, occurring in an invariable succession, namely, *first*, of the nervous or sensorial functions, *secondly*, of those of the circulation, and *thirdly*, of those of secretion and excretion; and that, though inflammation is something quite distinct from fever, it is nevertheless an almost constant attendant, constituting, in fact, that state of vascular excitement which marks the reaction of all febrile diseases. Dr. Smith admits of only two possible exceptions to the universality of this connexion of inflammation and fever; the first being in those very mild forms in which there is no opportunity of proving the existence of inflammation by dissection, and the symptoms are not such as to prove it without this aid; the second, in those very severe cases in which death takes place in the earliest stage, before inflammation could be developed.

A disposition to return to the fluids, as the main source of at least idiopathic fever, has of late been strongly evinced. Many now believe that the miasmatic, epidemic, and contagious causes of fever act mainly upon the blood, and that the morbid phenomena are due to the unhealthy influence upon the system of that fluid in its altered state. There can be no doubt that the blood is often greatly altered in fevers arising from the causes mentioned; and it is possible that, in many instances, this alteration is primary and the direct cause of other changes; but, in the present state of our knowledge on this point, the assumption that all fevers, or even the particular fevers referred to, are dependent exclusively on the morbid state of the blood, is not, I think, warrantable. Very often, when examined in the early stages of fever, that fluid presents no appreciable change; and, even when its alteration has preceded an open attack of fever, it is possible that the result may have taken place in consequence of morbid impressions already made upon the solids.

7. *Nature of Fever.*

That fever is a general disease, affecting all the functions, must be obvious to those who observe the phenomena which it presents. This is true, whether we consider the functions of associated parts, as of the apparatuses or systems which compose the general system, or those of particular organs. The pains in the head, back, and extremities, in the earlier stages, the various disordered sensations, the altered sensibility and muscular weakness, the mental debility or confusion, with many other occasional or constant phenomena, evince, beyond all possibility of doubt, derangement of the nervous system. The loss of appetite, loathing of food, diarrhœa or constipation, nausea, vomiting, &c., no less plainly indicate disordered digestion. That the circulatory function, and, as a necessary consequence, that of absorption are deranged, is too obvious to require proof. The hurried or anxious breathing, and the often deficient arterialization of the blood, prove that respiration participates in the general disorder. Secretion is universally affected, being generally deficient, sometimes too copious, and often quite deranged. That the nutritive function is almost suspended is proved by the length of time during which life is often sustained in fevers without food. The calorific function is almost invariably more active than in health, in fully developed fever. If each of the organs be taken in like manner successively, they will be found, without exception, to be more or less disordered. We are justified, therefore, in considering fever as a disease of the whole system.

The question now arises, can this disease exist of itself, or is it necessarily connected with and dependent upon some local lesion; in other words, can it be *essential* or *idiopathic*, or is it always and necessarily *symptomatic?* I believe that general opinion is correct in considering it sometimes as one, and sometimes as the other. The advocates of the exclusive local dependence of fever have thrown away much eloquence in combating a chimera, which they denominate ontology, as if their opponents believed in the existence of something distinct and independent of the system, under the name of fever. All that is maintained by the essentialists is, that in fever all the functions are disordered, without any necessary dependence upon disease in one particular part.

In maintaining the existence of essential fever, it is not necessary to support the notion of universality in the action of its cause. This may or may not be the case. The probability is, that some causes act locally on one organ exclusively, others act generally on several organs, some universally on all. But, when an essential fever arises from a cause acting upon a particular part, the first impression, after setting the febrile movement a going, is no longer absolutely necessary to it, and may cease altogether. Otherwise the fever would be symptomatic of the local affection.

I propose in this place to offer some arguments in proof of the occasional independent existence, or idiopathic nature of fever. They who maintain a contrary opinion, with the exception of the humoral pathologists, ascribe fever to local inflammation exclusively. The arguments will, therefore, be directed especially to that point.

1. Fever often occurs without exhibiting any certain, or even probable evidence of inflammation of any one organ, either at its origin or during its course. There is always derangement of function; but this is not necessarily connected with inflammation. Pain is sometimes wholly wanting, and when present, especially in the early stages, is often obviously of the neuralgic character. The most accurate examination fails to discover the usual physical signs of inflammation. It is true that, in fatal cases, dissection generally reveals appearances which could only have resulted from this cause. But it must be borne in mind that the febrile movement has a strong tendency to generate inflammation, and, though it may be entirely free from this complication at the commencement, will very frequently induce it, if sufficiently protracted and severe to destroy life. Indeed, fever proves fatal, in very many cases, through the instrumentality of the inflammation which it excites. So far, therefore, are these appearances from proving the fever to have been produced by the inflammation, that it would be surprising were they absent in protracted and fatal cases of this disease, though free from inflammation at the commencement. The onset of the inflammation, when it takes place, is generally sufficiently striking to engage the attention of the physician. But the post-mortem appearances of this affection are not always present, and, when they exist, are often in a degree, which evinces that it could have been the cause neither of the fever, nor of the fatal issue. In the absence, therefore, of proofs of inflammation, we have no right to assume its essential existence; and the disease should be taken for what it seems, namely, mere functional disorder.

2. If fever always originated from local inflammation, there should be, in those varieties deemed idiopathic, as there is in the proper phlegmasiæ, some pain or other indication of the local disorder previously to the commencement of the fever. It must be admitted that this is not always the case in fevers universally considered as symptomatic; but it is so as a general rule; and, therefore, as a general rule also, evidences of inflammation should precede other

fevers, if they are to be considered as phlegmasiæ. But this does not happen. In the great majority of cases of fever, usually called essential, there is no certain evidence whatever of antecedent inflammation. On the contrary, the preliminary symptoms are rather those of depression than excitement, and indicate disorder rather in the nervous than the circulatory system.

3. When fever arises from inflammation, we expect it, in general, to be proportionate, in some measure, to the violence of its cause. We do not look for a very violent fever from a very slight inflammation. Now we often have fevers consisting of a single short paroxysm, or of recurring paroxysms, with perfect intermissions; and, in these cases, the febrile movement is frequently of the very highest grade. If the fever depended on inflammation, this also should be severe; and yet it is scarcely possible to conceive of a violent inflammation, sufficient to produce intense fever, continuing only for three or four hours. Severe inflammation usually requires some time for its developement, some time for its increase, and some time for its decline. It seems evident that an inflammation, capable of producing the paroxysm of an intermittent, must be of so high a grade as scarcely to leave a doubt of its existence; and yet, never till the present century did it occur to the most observing physicians that inflammation is an invariable attendant upon this disease. If inflammation be the cause of intermittents, it must be internal; why does not external inflammation, which is obvious to the senses, occasionally pursue the same course, and give rise also to intermittent fever? The want of such cases of external origin may justify the suspicion, that those persons may be mistaken who conjecture the existence of internal inflammation in intermittents; and if it be not the cause of this form of fever, there is reason to suppose that there has been an equal mistake in ascribing other forms, hitherto regarded as idiopathic, to the same cause.

If the general truth be established, that fevers may exist independently of inflammation, those theories fall of course which ascribe them invariably to inflammation of some particular organ. Still, it may not be improper to offer a few observations upon the most prominent theories of this kind presented to the public. Clutterbuck, it has already been stated, seated all the fevers, usually called idiopathic, in the brain. A sufficient refutation of his theory is, that, though perhaps in all cases of fever there is more or less nervous disorder, yet often no symptoms exist which would call attention particularly to the brain, and very often dissection discovers no satisfactory evidence of inflammation in that organ, or its appendages. But the doctrine of Broussais is more plausible, and has obtained much wider currency. I shall, therefore, present somewhat more at large the considerations opposed to it. The reader will recollect that Broussais' theory regards fever as gastritis, or gastroenteritis; the intestines, according to that author, always exhibiting marks of inflammation, when the stomach is found to have been inflamed, in fatal cases of fever.

I admit fully that the stomach is always disordered in fever. Evidence of this fact has already been presented. That the same organ is often inflamed is equally beyond doubt. The burning sensation, the uneasiness or pain in the epigastrium, the tenderness upon pressure, the frequent nausea or vomiting, as well as the appearances after death, are sufficient proofs of this fact. But pain, tenderness, and nausea, are not unfrequently wanting; and dissection does not always reveal marks of inflammation. Even when supposed signs of inflammation have been discovered after death, they are often in fact not at all to be relied on; as redness, both in patches and in arborescent ramifications, is not unfrequently presented by stomachs perfectly healthy, in persons, for example, who have died by violence. The late Dr. Parrish found the same appearance in the gastric mucous membrane of hogs, which had been bled to death at the shambles; and the most experienced pathologists say that it is difficult, if not impossible, to discriminate between this merely physical phenomenon, and the redness of inflammation, unless some other marks of this diseased condition be presented. Thus, then, it appears that the gastric mucous membrane is found, in cases of death from fever, without any signs of inflammation, and that often, when these signs apparently exist, they are in fact delusive. But the advocates for the gastric theory maintain that inflammation may have existed without leaving a trace discoverable upon post-mortem examination; and they appeal to the disappearance of the redness after death, in cases of superficial inflammation of the skin. It is, however, utterly impossible, from the very nature of the inflammatory process, that this should exist with sufficient violence, or of sufficient duration to occasion death, without leaving some marks, either of congestion, exudation, softening, or other organic change, discoverable by close inspection. Even in the skin, unless exceedingly slight or transient, it produces some derangement of structure evident after death. Those cases of poisoning by arsenic, in which the stomach retains its healthy colour after death, have been adduced in proof of the assertion, that, even after fatal inflammation, the redness may entirely disappear. But these cases are more reasonably explained upon the supposition, that the deadly influence of the poison upon the nervous system has destroyed life so speedily, that there was no time for the establishment of inflammation; just as the poisonous cause of fever occasionally proves fatal by its first depressing influence, before reaction can take place. The inference, therefore, from the occasional perfectly healthy appearance of the stomach after death, that it was not inflamed during life, remains unaffected; and, if inflammation can be shown to be absent in a single case, the theory is disproved.

But what are the evidences, independent of those offered by dissection, which are relied on to prove the invariable presence of gastritis? The sensation of heat, the intense thirst, the relief afforded by cold drinks, and the distaste for hot and stimulating drinks, and for all kinds of food, have been mentioned. It is true that these symptoms are very generally present; but have we not also a hot skin, and are not cool liquids as agreeable to the surface as to the stomach? and yet it is not maintained that the skin is inflamed. Thirst is not especially a sign of gastric inflammation. It perhaps more frequently indicates a particular condition of the blood, which calls for dilution. The distaste for hot drinks may indicate the existence of gastric heat, but not necessarily inflammation. The distaste for food proves a loss of digestive power, and frequently exists in the state most opposite to inflammation. Other indications of inflammation which have been mentioned are nausea and vomiting, and the red and coated tongue. The first two are often present, but they are also frequently absent, and, even if they were invariable attendants, would not prove the existence of inflammation; as they often indicate mere nervous irritation of the stomach, or of the centres which supply it with nervous influence; and are quite compatible with true debility of the organ. The red and furred tongue has very generally been considered as indicative of gastric disorder; but the investigations of Louis and others have shown conclusively that no certain inference can be drawn from the state of the tongue, in fevers, as to the state of the stomach. The tongue appears to feel, like all other parts of the body, the influence of the morbid cause. That it is so often disordered simultaneously with the stomach proves that they are exposed to the same influence, not that the disorder of one is dependent upon that of the other. Hence, the cleaning of the tongue is one of the best evidences of the decline of the fever. It is said that leeches to the epigastrium, are speedily followed by improvement in the appearance of the tongue. This is often true, and the fair inference is, that irritation or inflammation of stomach may exist in such particular instances, and aggravate the general fever. But very often, also, no such effect is experienced. Leeching to the temples would have a similar influence if cerebral irritation should exist. It is not, however, intended to deny that there is a sympathetic connexion, to a certain extent, between the tongue and the stomach; the only point maintained is, that this connexion is not sufficiently close to justify the inference, that, because the tongue is red in fever, the stomach is inflamed.

If gastritis were the cause of fever, it should always precede it. We certainly very often have evidences of derangement of stomach before the attack of fever; but there is no proof that this derangement is inflammation. It might as well be maintained that the nervous symptoms, which are much more prominent than the gastric, are proofs of the existence of inflammation of the brain. Besides, the gastric disturbance is by no means an invariable antecedent. I have known a severe febrile paroxysm to commence immediately after a hearty dinner.

The phenomena of intermittent fever afford one of the strongest objections to the gastric hypothesis. This disease is cured by remedies which powerfully irritate the mucous membrane of the stomach. Quinia often produces great gastric irritation, and Peruvian bark still greater. Arsenic, which is a powerful gastric irritant, is perhaps, next to quinia or bark, the most effectual remedy. Intermittents are occasionally cured by black or red pepper, taken between the paroxysms. When an organ is peculiarly disposed to inflammation, the application of an irritant is generally supposed to favour the disposition; and substances of this kind are the last preventives we should be disposed to resort to.

It is, therefore, by no means an established fact, that the fevers commonly considered as essential or idiopathic are gastro-enteritis; much less those denominated symptomatic. Undoubtedly fever may arise from inflammation of the stomach and bowels; but it then takes rank with the other phlegmasiæ. Nevertheless, gastritis is a frequent attendant upon fevers, much more so than was believed before Broussais called attention to the fact; and there is no doubt that the treatment of these diseases has been favourably modified by the new light thrown upon them by this author and his disciples.

Admitting fevers to be in some instances idiopathic, in others symptomatic, the proper febrile movement, from whatever cause it may proceed, and however it may be complicated in different cases, is of the same essential character. The functions are deranged, and in such a manner that all recognize the disorder when they encounter it. There must, therefore, be something in the different febrile diseases common to the whole of them, and to this the name of fever properly belongs.

It is an interesting question what is the nature of the derangements in the functions. The mere statement that they are universally disordered gives no definite notion of the disease. But it is by no means an easy task to explain the nature of the derangement. Some of the functions are in a state of irritation, some probably of depression; but if we attempt to review the whole of them, and point out which are in the one state, and which in the other, we find that in many instances the symptoms do not afford us grounds for a positive decision; and we can derive no aid from organic changes; for these, when they do occur, are not essential. The order in which those states succeed each other, and the chain of mutual dependence which connects them, equally elude our search. It is possible that there may be something peculiar in the irritation and depression. But if such peculiarity exist, we cannot point out its nature. Together with disorder of the solids, there is very frequently an altered state of the blood; but the question has not yet been settled, whether this is an essential part of the disease, and important in the chain of causation, or a mere incidental effect. We are thus in a condition of uncertainty upon almost all points.

Theorists have failed in endeavouring to trace the complicated disorders of fever to some common source, and to point out a particular succession, a particular and necessary line of march, in the progress of the affection. The universal disturbance of function which constitutes the disease may be brought about in various ways; and the starting-point may be entirely different in different cases. Yet among the great majority of cases, there is a close analogy in the mode of onset, which must be ascribed to some common principle. Whether the fever is idiopathic or symptomatic, the first decided step towards its formation seems to be some morbid impression upon the nervous system, and this impression seems to be of a depressing nature. The phenomena immediately preceding, and those attendant on the chill, are for the most part unequivocally those of depression. The whole nervous system appears to have received a shock from the cause, cramping, and occasionally for a time almost deadening its energies. Something analogous to this we have in the effects of a severe surgical operation, of a severe injury in any part of the body, and of sudden alarming or afflictive intelligence. Along with the diminished exercise of the nervous function, is necessarily a diminution of all those functions dependent upon it. We may thus partially explain the condition of the chill; but there is something more which we do not fathom; something in which the chill of fever differs from other instances of nervous depression. Upon principles which have already been explained, the general prostration is succeeded by reaction, and the fever is then established. But there is here also something more than mere reaction. There is the continued action of the cause, a diversified play of sympathies in one case, a widely pervading influence from some unknown agent in another; and fever is not purely, as some have maintained, the *resilience* of the bowed down system. A proof of this is, that the febrile excitement is by no means proportionate, in all cases, to the initial nervous depression. To unravel this complicated web is in the present state of our knowledge impossible. We are too little acquainted with the precise reciprocal action of the organs, with the nature of the nervous power by which this reciprocal action is maintained, and, in many instances, with the cause of the disease and its mode of operation, to enable us to advance far beyond conjecture. We know that the heart, arteries, and capillaries are in a state of super-excitement, and the blood often disordered; that, under the combined influence of the nerves and blood-vessels, calorification is increased; that all the secreting surfaces, including that of the stomach, and all the secreting glands, and the whole process of nutrition, are deranged; sometimes probably being irritated, sometimes depressed, and sometimes peculiarly affected, under the influence of peculiar causes.

But in many instances of fever, even the imperfect concatenation above described is not evinced. Not unfrequently, the stage of chill is so slight as to preclude any idea of its agency in inducing the succeeding stage, and sometimes it is entirely wanting. In these cases, we must suppose the various derangements constituting the fever to be induced by the exciting cause, without a preliminary action specially upon the nervous system. Either the cause enters the circulation, and reaches all the organs so as to act on all simultaneously, while at the same time it may be acting on the blood, or it affects some one part primarily, from which an influence is conveyed sympathetically over the system. The latter was the opinion of the late Professor Chapman, who traced most fevers to an original morbid impression made upon the stomach. His opinion was promulgated in lectures before the annunciation of Broussais' hypothesis. But in ascribing fever to a gastric origin, Dr. Chapman did not consider the affection of the stomach as necessarily inflammation, nor did he consider the original impression upon this organ necessary for the continuance of the fever which it has set in motion.

Article VI.

DISEASE WITH PECULIAR PRODUCTS.

The diseased conditions now to be considered are recognized by peculiar products, not necessarily the result of any exciting or depressing agency, whether ordinary or specific. They may be included under two divisions; the first embracing those in which the new product, if organized at all, has a very feeble organization, the tendency of which is rather to decay than to growth or reproduction; the second, those in which a new body is produced, having a life of its own, and capable of indefinite extension, if not of generation.

I. DISEASE WITH UNORGANIZED OR FEEBLY ORGANIZED PRODUCTS.

The most important of the affections belonging to this category is beyond all comparison, tuberculous or scrofulous disease; and melanosis may be ranked under the same head. These are constitutional diseases, exhibiting themselves by their peculiar deposits in various parts of the body, where they give rise to phenomena differing according to the locality. Their presence and effects in the several positions in which the deposit occurs may be considered as constituting distinct diseases, and will be treated of as such. In this place, we are concerned with the general affections, independent of locality.

TUBERCULOSIS.

Syn. *Tuberculous or Scrofulous Disease.—Strumous Disease.—Scrofulosis.*

In certain states of the system, a solid extravasated matter is deposited in various parts of the body, which, from the shape ordinarily assumed by it, is called *tubercle.* The morbid state of system which leads to this deposition may be denominated the *tuberculous diathesis.* It is closely analogous, if not absolutely identical with that which usually precedes the development of scrofulous tumours, and which is denominated *scrofulous* or *strumous diathesis.* In this work, they are considered as one affection. When this state of system becomes decidedly and obviously morbid, it is sometimes called *tuberculous, scrofulous,* or *strumous cachexia.*

The tuberculous deposition takes place in one of two forms; either that of small, isolated bodies, or that of irregular infiltration into the tissues. In either case, the matter as first deposited may be gray, semi-transparent, and hard, or yellow, opaque, and rather soft. According to Laennec and Louis, the deposit is originally of the former character, and afterwards assumes the latter. But the matter is often found in both conditions at the earliest period at which it can be examined; and it seems to the author that, unless otherwise proved, it must be allowed to have been thus deposited.

The minute, isolated bodies are called *miliary tubercles*, or *tuberculous granulations*. When gray, semi-transparent, and hard, they are sometimes distinguished by the name of *gray semi-transparent granulations;* when yellow, and of a caseous consistence, they are denominated *yellow miliary tubercles*. They do not at first exceed a millet seed in size, but gradually increase till they become as large as a cherry stone or larger. When they are at first of the gray semi-transparent variety, a yellow spot soon makes its appearance within them, which enlarges by degrees until the whole tubercle is converted into a yellow, opaque, curdy matter, so soft that it may be crushed between the fingers. Sometimes they are in this state when first observed. The process of change continues, the softness increases, and the tubercle at length breaks down into a pus-like matter, with which are often mingled portions of the tuberculous substance in a cheesy form. This sort of mixed matter may sometimes be found in the centre of the tubercle, while the circumference remains still hard and unaltered. Not unfrequently, numbers of the miliary tubercles are aggregated together, forming a considerable mass; in which case, several points of alteration may be observed in different parts of it.

The infiltrated tubercle may be in the shape of large irregular masses, as in the lungs, of flattened patches, as upon the serous membranes, or of sheaths to the blood-vessels, as about the veins of the pia mater. (*Louis.*) It undergoes the same changes as the isolated tubercles, from the gray and semi-transparent, through the yellow, opaque, and soft, to the semi-liquid pus-like matter.

When thus mature, the tubercle excites inflammation and consequent ulceration in the surrounding tissue, by which, in many instances, a passage is made for the escape of its contents. The walls of the resulting cavity, which are sometimes lined by a sort of cyst, sometimes consist only of the consolidated surrounding tissue, secrete pus, which continues to be discharged for a long time, often mixed with the curdy matter. In many instances, however, a healing process at length takes place, the cavity is filled, and a cicatrix only remains. This is especially the case in scrofulous affections of the lymphatic glands. Sometimes, there is reason to believe that it takes place also in the lungs, though in the latter, the process of deposition and destruction generally goes on more rapidly than that of reparation, and the result is fatal. Sometimes, instead of the series of changes above described, the tubercle undergoes another process, by which the organic matter is absorbed, and an earthy or chalk-like substance is deposited in its place. This may always be regarded as a favourable termination.

The time occupied in these transformations is very uncertain. Sometimes the tubercle remains long quiescent in its original form; and, when the change begins, it may be completed in a few weeks, or may continue in progress for years. Not unfrequently, the disturbance produced by the tubercles in the tissue in which they are deposited proves fatal before they have passed even their first stage. This is more apt to happen when they are deposited in vast numbers, as sometimes in the lungs and the serous membranes.

Tubercles may be formed in almost any portion of the body, and often exist in many parts at the same time. They are most frequent in the lungs, and, indeed, in adults, are seldom found in other parts, without existing also in greater or less number in that structure. This, however, is not a universal rule. In children, they are often found elsewhere, though wanting in the lungs. After the lungs, the parts most frequently affected are, according to Louis, *first*, the lymphatic glands; *then* the pleuræ, the intestines, the spleen, the liver, the peritoneum, the membranes of the brain, the brain itself, and the bones; and, *lastly*, the pericardium, stomach, kidneys, pancreas, &c.* In their various positions, they produce great disturbance in the surrounding tissue, and give rise to morbid affections, which have received different names according to their seat and character. Thus, in the lungs they produce phthisis; in the pleuræ, chronic pleuritis; in the peritoneum, chronic peritonitis and abdominal dropsy; in the mesenteric glands, tabes mesenterica; in the arachnoid, hydrocephalus; in the lymphatic glands, external scrofula; and in the bones, white swellings, caries, necrosis, &c.

All ages are liable to tuberculous disease, but the two extremes of life are most exempt. From the researches of M. Papavoine, it appears that before the end of the second year it very seldom occurs; from this period to the end of the fourth year, is more frequent; and from four to thirteen, is exceedingly frequent. After the age of puberty, there is some exemption; but the liability returns towards that of maturity, and from eighteen to thirty-five or forty, is very great. After this it lessens, and the disease is rare in old age, at least as an original affection.

It must be evident, from the foregoing account, that this is not a local disease. The tubercles can appear in so many different parts at the same time, only in consequence of some general depravation of the system. In what this depravation consists is not evident. It has been thought to occur preferably in individuals, who present certain natural physical traits. Thus, persons have been said to be peculiarly predisposed to it, who have a clear-white or rosy complexion; a soft, delicate skin; large lustrous blue eyes, with long eyelashes, and a pearly sclerotica; thickness of lips, especially the upper; a narrow flattened chest with high shoulders; and, in childhood, a bright, active spirit, and precocious intellect. Dr. Wilshire has called attention to a very hairy condition of the skin, in children, particularly on the forehead, arms, back of the neck, and between the shoulder blades, as peculiarly indicative of a tuberculous predisposition. (*Lond. Med. Times*, Ap. 10, 1847.) There is no doubt that persons with the above characters have often been subjects of tuberculous disease; but too much stress was at one time laid upon the complexion, and the colour of the hair and eyes. Observation has shown that about as large a proportion of persons with dark hair, dark eyes, and a swarthy complexion are affected, as of those with opposite physical characters. Negroes are, in this climate, more disposed to the disease than the whites.

But more confidence may be placed in the signs which indicate a commencing developement of disease, and which often long precede the deposition of tubercle. Such are a pale, somewhat puffy countenance; swollen lips, which are apt to be sore and chapped in cold weather; tumefaction about the nostrils;

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* From a personal observation of thirteen or fourteen thousand cases, Rokitansky gives the following as the order of parts, in reference to their liability to tubercle in the adult: 1. lungs, 2. intestinal canal, 3. lymphatic glands, especially the abdominal and bronchial, 4. larynx, 5. serous membranes, especially the peritoneum and pleura, 6. pia mater, 7. brain, 8. spleen, 9. kidney, 10. liver, 11. bones and periosteum, 12. uterus and Fallopian tubes, 13. testicles, prostate, and seminal vessels, 14. spinal cord, 15. muscles of animal life. In children, the lymphatic glands and spleen are most frequently affected, and after these, the lungs, bronchial mucous membrane, brain, serous membranes, &c. This order, it will have been perceived, differs somewhat from that given by Louis. It relates, however, only to the comparative frequency in which the tubercles are found in the several organs after death. The order of frequency in reference to the primary attack is very different. Here the lungs and lymphatic glands maintain the precedence; while the intestines, larynx and trachea, serous membranes, spleen, and liver are so low on the list as to indicate that they are scarcely susceptible of a primary attack. (*Note to the second and third editions.*)

occasional purulent discharges from the nostrils or ears; a tendency to soreness of the eyes, and especially to a vesicular eruption upon the conjunctiva; vesicular eruptions behind the ears, and in different parts of the head and face; sourish or otherwise disagreeable exhalations from the skin; slight swelling and induration of the glands of the neck, and enlarged tonsils; a rickety condition of the bones; a weak but excitable pulse; flabby muscles; a rapid increase in height, without corresponding lateral developement; and general weakness, indicated by fatigue after moderate exertion. It is not to be supposed that all these symptoms are present in every case; but enough of them frequently are so to justify solicitude, and to lead the prudent practitioner to the adoption of preventive measures. Not unfrequently, a slight febrile movement, rather occasional than persistent, is observed in addition to the other phenomena; and, indeed, such a movement is sometimes the immediate forerunner or attendant of a copious tuberculous deposition.

The tuberculous diathesis is also characterized by the modified condition of the inflammatory process which it produces. Inflammation, occurring in systems under its influence, very generally assumes a slow or chronic form, is accompanied with comparatively little heat or pain, and, after suppuration, leaves abscesses which heal very slowly, and are sometimes exceedingly obstinate. The affection, under these circumstances, is distinguished by the name of *scrofulous inflammation*. It is very often the immediate result of the tuberculous deposit, acting as a foreign body, and irritating the neighbouring parts; and the purulent discharge is frequently mixed with broken down tubercle in the form of curdy matter. But the deposition of tubercle is not a necessary attendant of all cases of scrofulous inflammation. The diathesis appears sometimes of itself to predispose to inflammation; and, when that process occurs from other causes, it often assumes the peculiar scrofulous character, even though no tubercles may be present.

After the formation of tubercles, and during their maturation and discharge, the system often sympathizes strongly, and there is almost always, at first, a simple irritative fever, and afterwards, when suppuration has become established, more or less hectic fever, which, in severe cases, rapidly exhausts the remaining strength.

From the experiments of M. Dubois, of Amiens, it would appear that the blood, in scrofulous cachexia, has a smaller proportion of coagulable matter in relation to the serum, and that the serum itself is of less specific gravity than in health; while the red colour of the liquid is, in some degree, independent of the red corpuscles, as if these had undergone a partial disintegration. (*Dict. de Med.*, xxviii. 221.) The blood is, therefore, watery and impoverished, and incapable of supplying the nutritive function sufficiently. But it should be stated that Lebert, in the examination of many cases, never observed the reddened serum noticed by M. Dubois. (*Traité Pratique des Malad. Scrof. et Tuberc.*, p. 33.) Dr. Glover inferred, from a series of original experiments, that the albumen is increased and the blood corpuscles diminished. (*Pathol. and Treat. of Scrofula*, *Lond.*, 1846, p. 115.) In phthisis, according to Andral and Gavarret, the proportion of the red corpuscles diminishes, and that of the fibrin increases with the advance of the disease. That of the red corpuscles is almost always below the healthy standard; that of fibrin often above it. But the increase of the fibrin is a result of the inflammation occasioned by the tubercles; and we have no proof that it is in excess under other circumstances. From the observations of Nicholson it may, indeed, be inferred that the fibrin is, in many instances, diminished.

What is the nature of this affection, denominated tuberculous disease, but of which the tubercle is a mere incident, though a very general, characteristic, and most important incident? This question cannot be fully answered, in the present state of our knowledge. We know that, generally, the vital energies are enfeebled, and the blood impoverished or depraved. It is highly probable that the tendency to the tuberculous deposition is due directly to the condition of the blood. But the state of the blood must itself be dependent upon some deficiency or depravation of the functions by which it is elaborated, and we are thrown back upon some original vice in the organic constitution.

A knowledge of the causes which favour the developement of the disease, may aid us somewhat in understanding its nature. These are almost all of a character fitted to lessen the energies of the system, and to impoverish the blood. Insufficient food, confinement, want of fresh air and exercise, habitual exposure to cold, sensual excesses, great loss of blood or other depletion, and the depressing passions, greatly favour the developement of tubercles, and even appear capable sometimes of producing the diathesis. It has been found, by experiment, that tubercles are generated in some of the lower animals by close confinement. But there are many individuals upon whom all these causes may be made to operate, and so intensely even as to produce fatal effects, without giving rise to this particular disease. Indeed, it is probable that the great majority of mankind might perish, under these circumstances, and give no sign of tubercles. There is something more, therefore, than mere debility. There is some inherent peculiarity of the organization, generally derived or inherited from the parent, which serves as the basis of the disease. The other causes are in general merely exciting. They, no doubt, often induce the disease, when it might otherwise never have been developed; but they are generally incapable of producing it, unless in subjects having some innate disposition towards it. In the great majority of fatal cases of tuberculous disease, the original and essential cause will probably be found to be an inherited peculiarity of organization.

It has been supposed by many that tubercle is a product of inflammation, and differs from other products of the same process only in consequence of the peculiar character of the fluids, or the deficient energy of the solids, or the conjectural circumstance, that the white vessels, or those carrying only colourless blood, are especially affected. But a sufficient refutation of this opinion is, that, in a vast number of cases, tubercles exist without any inflammation whatever, evinced either by the symptoms, or by anatomical examination. No fact in pathology is better established than this. Undoubtedly, inflammation is often found in connexion with them. But it is generally a result, and not a cause. It comes on after the tubercles have been formed, and not before them. There is, however, reason to believe that the occurrence of inflammation, in an individual predisposed to tubercles, favours their production. It causes exudation, and, if the material out of which tubercles are formed is present, this will probably be deposited along with other exuded matters.

The nature of tubercle has been a subject of some inquiry. Very different analytical results have been obtained by different chemists. An analysis by Dr. Glover gave for 200 grains of very pure tuberculous matter, in the crude state, 6.75 parts of fats, 7.50 of extractive matter soluble in alcohol and water, with loss, 0.45 of chlorides, 0.58 of earthy salts (phosphates), 0.50 of alkaline salts, 21.72 of protein residue, and 162.50 of water. (*Pathol. and Treat. of Scrof.*, p. 73.) The precise nature of the protein base of tubercle does not seem to have been satisfactorily determined. Some chemists profess to have found fibrin, others albumen, and others again casein and pyin. In the instance just stated, Dr. Glover could not detect a trace of either of the two last-mentioned principles. In another experiment, he found what he considered to be albumen and pyin, but never succeeded in obtaining casein.

The microscopic constitution of tubercle has been definitively ascertained by M. Lebert, whose statements have been essentially confirmed by subsequent observers. The constituents, before the softening of the tubercle, are 1. a hyaline, formless substance, 2. molecules or molecular granules in great numbers, and 3. peculiar and characteristic corpuscles; the two latter being held together by the translucent material first mentioned. The corpuscles are quite distinct from all others. They are seldom perfectly round, but are irregularly polyhedral with rounded angles, approaching sometimes the spherical, and sometimes the oval form. Their diameter varies from about $\frac{1}{5000}$ to $\frac{1}{2500}$ of an inch. Within the transparent envelope is a somewhat translucent matter, probably of a solid consistence, in which are embedded from three to ten or more granules. Water does not change them. Acetic acid renders them more transparent, and enables us to determine positively that they contain no nucleus; by which circumstance, as well as by their shape, and their much smaller size, they are readily distinguishable from pus corpuscles. In only one instance did Lebert ever detect a nucleus. These peculiar corpuscles are found in all varieties of tubercle. They are numerous and closely compacted together, and to this circumstance probably owe their irregular form.

When the tubercle softens, the cementing hyaline substance liquefies, and the corpuscles thus set free imbibe apparently a portion of the liquid, become somewhat larger, and assume a spherical shape. In the progress of the change, the cell-wall ultimately dissolves, and the included granules are liberated, thus increasing this constituent of the tuberculous mass. In this condition, the matter bears to the unassisted eye a considerable resemblance to pus, from which, however, when examined by the microscope, it is found to differ essentially, as it never contains the pus corpuscle; and, whenever this body exists in tuberculous matter, it is always derived from the neighbouring tissues. When pus from some external source, as frequently happens, becomes mingled with the softening tubercle, it hastens its dissolution and conversion into a granular fluid. In some instances, after being thoroughly liquefied, the tuberculous matter is absorbed, leaving only saline or calcareous matter, which, appearing first in points, gradually increases, and at length forms an aggregate chalk-like body.

The above observations apply to the yellow tubercle. The gray or semi-transparent granulations contain fibres, the hyaline constituent sometimes finely granular, and the peculiar corpuscles, which, from their great compactness, are less easily distinguishable than in the other variety. According to Lebert, the fibres are derived from the tissues in the midst of which the tuberculous matter is deposited, and give transparency to the mass by separating the corpuscles. In the conversion of the gray into the yellow tubercle, the fibres are first destroyed, and the corpuscles being set free congregate in the centre, and, together with the granules which are formed, give yellowness and opacity to the mass. In the yellow miliary tubercle there is little or no fibre unless at the very earliest stage of its formation, and the hyaline substance is more granular. The gray granulations are most frequent in the subserous areolar tissue of the pleura and peritoneum, and among the fibres of the areolar tissue of the lungs.

Besides the elements proper to the tubercle itself, others are often incidentally present; as the black matter of melanosis, fatty matter, and the incorporated fibres already referred to, all of which may exist in the tubercle before its disintegration; while afterwards are often added to it, from the neighbouring parts, blood corpuscles, the epithelial scales and other detritus of adjoining tissues, crystals of salts, and all the products of inflammation. (Lebert, *Physiologie Pathologique.*)

The readiest explanation of the phenomena successively presented by tubercles is, that a formless matter is first extravasated, having a low and feeble vitality, that, as the result of an imperfect attempt at organization, granules and peculiar corpuscles are generated, and that the tubercle thus formed grows like cartilage by imbibition, and then, as a result of the law of its constitution, undergoes a series of changes ending in its complete disintegration.

MELANOSIS.

This is a very rare disease, though more common in the inferior animals than in man. It is characterised by the deposition, in various parts of the body, of a peculiar black or dark-coloured substance, which has given origin to the name. This substance is deposited either in isolated masses, in the substance of the tissues, upon the free surface of membranes, or in the liquid form, in cavities whether natural or morbid.

The melanotic matter is most frequently in isolated bodies, which vary in magnitude from the size of a hemp-seed to that of an orange, and, in some rare instances, have been known much to exceed the latter dimensions. It is probable, however, that the larger masses are formed by the aggregation of the smaller. When single, these bodies are in general rather regularly spherical; but, when aggregated, are often very irregular, having a tuberculated surface, and sometimes resembling, in appearance, a string of beads, or a bunch of grapes. Their colour is dark, but of different hues, sometimes reddish-brown, sometimes of a bistre or soot colour, and occasionally bluish, violaceous, or black. They differ also in consistence, some having the firmness of a lymphatic gland, others the softness of suet, and others again being pultaceous or semifluid; and these different conditions may all exist in the same person, at the same time. They are in general nearly or quite inodorous, though sometimes said to smell disagreeably. When rubbed between the fingers, they impart to them a temporary stain. No trace of organization has ever been detected in them; and, if any signs of vascularity have been observed in the masses, it has been in the tissue which is occasionally involved in them, in consequence of the union of neighbouring deposits. In general, they are in immediate contact with the tissue in the midst of which they have been deposited; but, in some instances, they are enclosed in what appears to be a cyst, but which is probably nothing more than the condensed areolar structure around them. Under the microscope, they appear to be made up of unorganised granules, among which are sometimes seen cells from the neighbouring tissues enclosing the same dark matter.

When the black matter is infiltrated in the tissues, it seems sometimes to unite with them molecularly, colouring them uniformly, or appearing like dots produced by sprinkling dark granules over the surface. In this way it may unite with healthy structure, or with that which is diseased; as, for example, with the indurated fibrinous products of chronic inflammation, with tubercle, with scirrhus, or with medullary fungus. In these affections, the melanotic matter may be interspersed in granules among the proper constituents of the morbid structure, or may form a portion of the interior of its peculiar cells.

Occasionally, it has been observed in small patches, upon the free surface of the serous membranes, especially of the peritoneum. Some believe that they have also detected it on the mucous surfaces; and persons are not wanting who consider the black discharges of melæna and black vomit, as owing their colour to an identical product. It has certainly been found in the liquid form in cavities, either natural, as that of the abdomen, or formed by disease in one of the organs.

After deposition, the matter increases by further extravasation from the surrounding tissue, and not by growth. Laennec supposed that the little tumours underwent a softening process, similar to that of tubercles, and, like them, discharged their contents through ulceration. But subsequent investigation has shown that they have no inherent tendency of that kind. By pressing upon surrounding parts, like any other foreign body, they sometimes excite inflammation, and its consequences, serous and fibrinous effusion, suppuration, and ulceration. But the melanotic bodies, in these cases, act mechanically. They are usually very slow in their progress. In those cases in which melanosis has been supposed to pursue an active course, and to present the characters of tubercle or cancer, it has been the structure in which the black matter was deposited that has been the subject of the morbid process, and not the black matter itself, which has probably been quite innocent.

Various analyses have been made of the matter of melanosis. They generally agree in this one result, that it has the same character as the blood, though somewhat modified. Thus, it contains albumen, fibrin, various saline ingredients, iron, and a colouring substance which bears a considerable resemblance to that of the blood, and is probably derived from the red corpuscles. Some have supposed the melanotic deposit to be the same as the black pigment of the eye and hair, and of the skin in the negro. It is said that white horses are more liable to it than those which are darker coloured, and old gray-haired persons, among human subjects, than the young; and a theory of its nature, deduced from these facts, ascribes the affection to a sort of metastatic deposit; the colouring matter, which is no longer secreted in the hair, seeking an outlet in various parts of the body. Unfortunately, however, for this hypothesis, the complaint occurs also in dark-haired animals, and in men not yet gray.

That is a much more probable theory, which considers the disease to be a sort of interior hemorrhage, similar to that which produces the black vomit in malignant fevers; the blood probably undergoing an imperfect secretory change, at the moment of extravasation. But in the present state of our knowledge, all explanations are purely hypothetical. The affection is evidently connected with a peculiar diathesis, or constitutional tendency; as the deposition often takes place in different and distant parts of the body at the same time; and the melanotic tumours are very seldom solitary. Nor will it be venturing much, to suppose that the extravasation of the black matter depends immediately upon a disordered condition of the blood. But what is the nature of this disorder, what its causes, and what its characteristic signs, independently of the mere act of deposition, are all points upon which we are profoundly ignorant.

The melanotic deposition, though most frequent in the cellular and adipose tissue, may take place in any part of the body. It occurs, probably, more frequently in the liver or the lungs than in any other organ; but it has been observed also in the skin, upon the surface and in the substance of the serous membranes, in the coats of the blood-vessels, in the lymphatic glands, brain, kidneys, &c. In all these situations, it produces effects such as might be expected from a foreign body, and symptoms which of course vary with the functions of the part. There are no signs by which melanotic disease can be distinguished, during life, from others producing similar disorder of the functions, except when the affection exists in the form of one or more characteristic tumours upon the skin. In such cases, any existing internal disorder of apparent organic origin, may, with some degree of confidence, be ascribed in part or wholly to melanosis.

II. DISEASE WITH ORGANIZED PRODUCTS.—MORBID GROWTHS.

Morbid growths may be arranged in three subdivisions. The *first* embraces those in which the organized product has a close resemblance to some healthy tissue, without an independent power of nutrition or reproduction, and without malignant tendency. To this section belong cysts, and non-malignant organized tumours. The *second subdivision* includes those morbid growths which have a peculiar organization, and which, along with a malignant tendency, and an apparent power of repetition or reproduction, have yet a close nutritive connexion with the system. Such are all the varieties of carcinoma. To the *third* subdivision belong all independent organized bodies, formed and existing within the system, yet having a distinct life of their own, and depending on the parts about them only for a convenient nidus, and the materials of nutrition. These are the parasitic animals, or entozoa, which, under the names of *hydatids*, *worms*, &c., infest the human frame.

a. Organized Non-malignant Products.

These may be either cysts containing various products of secretion, or organized tumours with or without a cystiform envelope.

1. CYSTS.—Cavities are frequently formed in the body, containing liquid and solid matters, and bounded by membranous tunics, which, however, are the results of some of the processes previously treated of in this work, and do not, therefore, properly belong to the present section. Thus, matters foreign to the system, whether introduced from without, or the result of morbid processes within, excite inflammation in the surrounding tissues, and occasion the formation of a false membrane, which envelopes, and in some measure isolates them. Again, certain natural cavities are sometimes irritated into unhealthy action, and, by the consequent excess of their secretion, expand their walls, and sometimes acquire a great magnitude. Some of these are naturally closed, as the ovarian vesicles, the bursæ of the tendons, &c.; others are open in health, but are either unable to discharge the excess of their secretion, as the sebaceous follicles of the skin, or become closed by an inflammatory adhesion, as the cells of the areolar or adipose tissue. Thirdly, in consequence of obstruction at the outlet of cavities, or in the course of tubes, arising from inflammation, the presence of calculi, hardening of mucus, compression from without, &c., the healthy secretions accumulate behind the point of obstruction, and produce sometimes large tumours of an apparently encysted character. Such, for example, is the tumour under the tongue denominated ranula, and dependent on obstruction in the salivary duct. None of these, however, belong to the class of morbid affections that we are now considering.

The cysts to which allusion is here made are closed membranous bags, similar in appearance to serous membranes, capable of secreting from their inner surface, and closely connected, by their outer surface, with the tissues around them. Their contents are very diversified both in consistence and nature; being either liquid, semi-liquid, or solid, and consisting of serous, sanguineous, oleaginous, mucoid, or puruloid matter. Names have been given to them in accordance with the character of these contents. Thus, when the enclosed matter is watery, like the serum of the blood, they are said to be *serous;* when of the consistence of honey, *melicerous;* when similar to fat, *steatomatous;* and when of a soft, pultaceous consistence, like concrete pus, *atheromatous.*

They may be solitary or numerous, single or grouped together, and are of all sizes, from the smallest visible magnitude, up to that of a man's head, or larger. In general each cyst is simple, or complete in itself; but there are also *compound cysts,* first accurately described by Dr. Hodgkin, which are characterized by the outgrowth of smaller cysts from the inner surface of the original bag, similar to it in structure, and sometimes quite filling its cavity. The cystic walls occasionally become much thickened, and are liable to undergo various degeneration, in consequence of the deposit or formation in their substance of cartilaginous, calcareous, or bony matter. They are sometimes, like the healthy tissues, attacked with inflammation, in consequence of which, blood, lymph, pus, &c., may be mingled with the previous contents of their cavities. They occur in all parts of the body, except the cartilages, and perhaps the bones. In the abdomen, they occasionally give rise to that form of abdominal dropsy called *encysted.*

These cysts are formed without preceding inflammation, or appreciable disease of any kind. They seem to be the mere result of a perverted nutrition. Probably, one of the microscopic cells or cell-germs, which form the bases of most of our tissues, takes on, in some inexplicable manner, a new mode of action, which issues in the formation of a new body, having certain laws of its own, though with a close resemblance to some one of the healthy tissues, especially the areolar, or the serous. Though capable themselves, in consequence of the accumulation of the secreted matter in their cavities, of an almost indefinite expansion, and often attaining a very great magnitude, they have no power of converting the neighbouring tissues into structure analogous to their own; nor have they any essential tendency to degeneration. They prove injurious, as a general rule, only by their physical properties, such as their consistence or bulk, or by appropriating to themselves the nutriment which was destined for the healthy tissues, and thus producing a general atrophy.

But, in these modes, they are often the source of great inconvenience, and even danger. Their bulk and weight alone are occasionally the cause of much discomfort. They derange the functions, not only of the organs in which they are formed, but also of others in their neighbourhood, by displacing, compressing, or irritating them. Not unfrequently, inflammation is produced in the surrounding tissues, ending in their partial destruction by suppuration, ulceration, &c., or in a fibro-cartilaginous, or osseous degeneration. They not unfrequently obstruct, in greater or less degree, the outlets of secretory glands, the alimentary passages, the blood-vessels, and absorbents, and thereby produce serious and sometimes fatal effects. They occasionally burst from over distension, effusing their contents, with the most dangerous consequences, into neighbouring cavities. Finally, as before stated, they are themselves capable of taking on inflammation, and inducing many of the results, general and local, which follow that morbid process in the normal tissues.

These morbid growths are sometimes of local origin, and sometimes appear to depend upon a general depravation. But of their causes we know little or nothing. In relation to the modes of detecting them, the reader is referred to the diseases of the several organs in which they are produced.

2. ORGANIZED NON-MALIGNANT TUMOURS.—In almost all the organs and tissues of the body, organized structures occasionally form, distinguishable by their bulk, consistence, or nature, from the structure in or upon which they are developed. These are often the result of morbid processes already described, such as the effusion of coagulable lymph from inflammation, or simple

hypertrophy from excess of nutritive action, and, in such cases, do not belong to the section of diseases now under consideration. But, not unfrequently, they occur without any previous discoverable disorder, or any morbid action whatever, other than that which is indicated by their own formation. They are sometimes enclosed in a cyst, which may have been the origin of the morbid growth within it. Their structure is various, and they are named accordingly. Dr. Paget describes the following varieties; 1. *the fatty*, resembling the normal adipose tissue; 2. *the fibro-cellular*, resembling the ordinary fibro-cellular or areolar tissue; 3. *the fibrous*, imitating the normal fibrous or tendinous tissue; 4. *the recurring fibroid*, similar to the preceding in external appearance, but differing in their tendency to return after extirpation, and exhibiting under the microscope elongated caudate and spindle-shaped corpuscles, as if developing into fibres; 5. *the cartilaginous*, closely resembling fœtal cartilage in appearance and structure, but characterized by great diversity in the form and arrangement of their constituent cells, nuclei, and fibres, being in this respect analogous to carcinoma; 6. *the bony*, resembling bone, and often developed from the preceding; 7. *the myeloid*, or *fibro-plastic tumours* of Lebert, similar to the fibrous in appearance, but having a peculiar microscopic structure, which, though it may be somewhat fibrous and vascular, consists essentially of elongated caudate spindle-shaped cells, nuclei, and certain characteristic cells, large, dimly granular, and containing from two to ten or more nucleolated nuclei, all embedded in a dimly granular substance; 8. *the glandular*, imitating glandular structure, as that of the mamma; and 9. *the elastic* or *vascular*, consisting of blood-vessels, or of a tissue similar to the erectile. For a more particular account of these morbid growths, which it is not consistent with the objects of this work to describe minutely, the reader is referred to Mr. Paget's excellent work on surgical pathology.

The origin of these tumours is unknown. We may refer them, like the cysts just described, to the perversion of one or more of the nucleated cells or cell-germs, which retain their power of extension, under the ordinary nutritive influences of the system, and impart their peculiar properties to all the cells which spring from them. But the difficulty is only removed a step; for we are utterly ignorant of the cause of this perversion.

The tumours, so far as they are within reach, belong to the province of the surgeon. But, in some of the interior structures, they occasionally produce derangements which bring them under the notice of the physician. Their effects, in these situations, are for the most part simply mechanical, and analogous to those already described as resulting from cysts. Like them, too, they may undergo inflammation, the results of which may prove irritant to surrounding parts. Unfortunately, as they are without the circle of the ordinary systemic actions and susceptibilities, they are scarcely in any degree influenced by medical treatment. Sometimes they become the seat of malignant action, and then belong to the following section.

b. Malignant Growths.

CARCINOMA, OR CANCER.

These are peculiar morbid structures, with the property of indefinite propagation, the power of displacing or transforming to their own nature all neighbouring tissues, and a tendency to ultimate self-degradation, and the destruction of life. They may be dormant for a considerable time, even for years;

and an individual may go to his grave, at a good old age, of another disease, after having long borne their germs within him; but, if by any cause brought into action, their progress is essentially and irresistibly destructive. In this respect, they differ from tuberculous disease. Tubercles have an individual tendency towards health, but, in consequence of their abundant production, a general tendency to a fatal result. The structures under consideration have no reparative action. Their proclivity is altogether towards death. Hence they are very properly denominated malignant.

Pathologists are now generally disposed to include all these malignant growths under the general title of carcinoma, or cancer. These terms, especially the latter, have been frequently employed in a more restricted sense. Thus, cancer has been confined by some to the ulcerative stage of scirrhus; while the epithet *cancerous* has been extended to malignant affections of analogous character in any stage. There is a convenience, however, in having a general designation for all these structures; and the propriety of such a designation is indisputable, if the fact be admitted that they are mere varieties of the same disease, which is almost certain. In support of this opinion, the considerations may be adduced that all of them, in their earliest stage, often present certain common features, however unlike they may afterwards become; that all of them may occur in the same person, at the same time, and, according to Dr. Carswell, in the same organ; that the characters of the different varieties may even be presented in the same tumour, at different stages; that, in the progress of the disease, the secondary affection sometimes belongs to a variety different from that of the primary; and, lastly, that, after the extirpation of one variety by the knife, another may occur in the same, or another part of the body. They all, moreover, contain, in greater or less number, a peculiar cell, which may be considered as characteristic of cancer.

Anatomical and Microscopic Characters.—Only a single tumour may exist in the body, or there may be many, occupying the same or different organs. They may be a mere speck in size, or as large as the head of a man, and of any intervening magnitude. In shape, they may be irregularly globular, when surrounded by a structure of equable density; pear-shaped, fungiform, or like a cauliflower, when projecting from a free surface; in layers or patches, when in membranous tissues; and ramified, when the carcinomatous matter occupies the veins or absorbents. They generally have an irregular, as it were tuberculated surface; but this is by no means always the case. Their consistence may be very hard and almost stony, as in scirrhus; soft, like that of the brain, as in the medullary form of the disease; gelatinous, as in the colloid or gelatinous cancer; or liquid, like cream. The colour is generally white or whitish, sometimes inclining to yellow, brown, or red, according as oil, bile, blood, or other adventitious matter is present. When melanosis coincides with carcinoma, the latter is brown or blackish.

When a cancerous tumour is subjected to pressure, or scraped, a cream-like or gruel-like liquid is generally obtained, in smaller or larger quantity, characteristic of this kind of growth, and called "the cancerous juice." This liquid has the property of forming with water a uniform emulsion. It is usually of a pale, yellowish-white colour, but sometimes yellow, red, or black from the admixture of fat, blood, or melanotic matter. Colloid cancer is the only variety which does not yield it, the juice of this being gelatinous, and not uniting with water to form an emulsion.

When examined with the aid of a microscope, cancerous tumours are found to consist of three chief ingredients; 1. a fibrous tissue, 2. a viscous liquid or solid homogeneous blastema, contained within the meshes of that tissue, and 3. peculiar cells in different stages of developement. The proportion of these constituents is very different in the different forms of carcinoma; the fibrous being most abundant in the hard varieties, the liquid in the gelatinous, and the cells in the medullary. Dr. Bennet considers the coexistence of these elements as essential to cancer. According to Lebert, though fibres are generally present, they are not always so, being sometimes absent in very soft medullary cancer (*Traité Pratique des Malad. Cancéreuses*, p. 204); and Dr. Redfern has published an account of a cancer of the brain, in which they appeared to be wanting. (*Month. Journ. of Med. Sci.*, N. S. ii. 510.) Lebert considers the cells as the only constant and essential element; and he is probably correct. Blood-vessels are found in all the varieties of cancer, being abundant in some, in others scanty, and in others again distributed in clusters. Lebert states that he has never detected nerves or absorbents; but Schröder Van der Kolk twice succeeded in injecting lymphatics in the very substance of medullary cancer.

The cancer cells may be best seen by examining the expressed liquid with a microscope. They are of great diversity of form, being spherical, oval, irregularly quadrangular with rounded angles, triangular, spindle-shaped, caudate, bifurcated, heart-shaped, &c., all in the same drop of juice. They differ much in size, but are for the most part large, having a mean diameter of about $\frac{1}{1500}$ or $\frac{1}{1000}$ of an inch. Their nucleus is also large, not only in proportion to other nuclei, but to the size of the cell, of which it often occupies from one-half to two-thirds. It is usually excentrically placed, is round, or oval, and encloses from one to three large nucleoli. Besides the cells containing one or two nuclei, there are others called *mother-cells*, very large, sometimes exceeding $\frac{1}{400}$ of an inch in diameter, and enclosing from three to fifteen nuclei, which are by some considered as small cells, and occasionally present the proper cellular character. Still another cell is that called by Lebert, the *concentric*, in which a complete cell is surrounded by a distinct envelope, and sometimes by several envelopes concentrically arranged. The extra-nucleolar contents of the cell have a dull, finely-granular appearance, which, however, in no degree obscures the nucleus. *Naked nuclei* fully formed, and others in the course of developement, exist in great numbers intermingled with the cells; and *molecules* and *granules* are also dispersed through the cancerous juice. The cells are rendered more transparent by acetic acid, which has no decided effect on the nuclei.

The elements above enumerated are generally met with in cancerous structures, and may be considered as their proper constituents, though not all essential. According to Lebert, not more than two or three per cent. of cancers are destitute of the characteristic cells above described. Their absence in these cases he ascribes either to incomplete developement, as in some rapidly formed very soft medullary tumours, or to the degradation of pre-existing cells.

Besides the proper ingredients of cancer, others, purely accidental, are not unfrequently met with, such as fatty matter, melanotic matter, crystals, the different results of inflammation, the constituents of the blood in various states of degeneracy, and the elements of neighbouring tissues.

In degenerating carcinoma, the cells are variously changed. In some, the walls are much thickened and the nuclei converted into transparent vesicles; others are altered by imbibition, having their cell-wall distended and laminated, and their interior diffused; a third set exhibit a granular and fatty infiltration, giving them the appearance of compound granular corpuscles; a fourth shrink up and become dried by the exosmosis of their liquid contents; and a fifth are converted more or less completely into a mass of molecular granules, which appears to be their lowest stage of degradation. (*Lebert.*) But in almost all instances where these forms are observed, they occupy but a part of the tumour, while unchanged cells are found in other parts.

Chemical investigation has furnished no very satisfactory result in reference to cancer. Water, albumen, fibrin, gelatin, different kinds of fatty matter, iron, and various salts have been detected; but it is impossible to determine which of these, and what proportion of them, belong to the essential cancerous structure; as the coats of the blood-vessels and the contained blood necessarily modify the results.

Origin and Progress.—The disease first appears in a small spot, and gradually extends, or in several nearly contiguous spots, which coalesce. In either case it spreads by degrees, destroying the neighbouring structures, and forming a tumour, which varies in shape, size, and consistence, according to the circumstances under which it is produced. It appears to maintain a vascular connexion with the surrounding parts; but the veins are often filled with cancerous matter or coagulated blood, so that it is impossible to inject them. Hence the varicose condition of the superficial veins, so often observed in scirrhous tumours.

The constant tendency of carcinoma, when in action, is to extend itself by encroaching upon the neighbouring tissues. But the rapidity of its progress differs greatly, and has some relation to the character of the tumour itself. The hard varieties usually advance much more slowly than the soft. The progress of the disease is affected also by the age of the patient; being much slower in the old than in the young, and generally slow in proportion to the age. In the extension of the disease, contiguous parts are frequently involved, even though they have no connexion in health. But, in such cases, a union appears to have been previously effected by the adhesive inflammation. Thus, cancer of the stomach often extends to the liver; that of the uterus, to the rectum, bladder, &c. The disease is also apt to travel along the absorbents, and to seize upon the lymphatic glands in its course. Hence, the glands of the axilla are exceedingly liable to become affected by cancer in the breast, and those of the groin by cancer of the testicle. The propagation may be owing either to a sympathetic irritation, acting upon a cancerous predisposition, or, what appears more probable, to a transplantation of the cancerous germs through the medium of the absorbents. The disease very frequently also extends ultimately to various distant organs. Thus, the lungs are very apt to suffer in cases of external carcinoma. It is possible, however, that the result may be owing rather to a general carcinomatous diathesis, than to the mere propagation of disease from a single point.

One of the characters of advancing carcinoma is gradually to soften, and ultimately to ulcerate. The hard varieties are sometimes converted into the soft, and the soft become softer; and both, in the end, occasionally assume a diffluent consistence like that of cream. The process of softening may commence in any part of the tumour. It is usually attended with increased vascularity. The disease, in most cases, if not sooner fatal by its influence upon the system, or entirely destroyed by gangrene, ends in ulceration. The resulting ulcer is of an aggravated character, with ragged and inverted or everted edges, often deep excavations, a sanious and extremely offensive discharge, and a frequent disposition to bleed and to slough. Gangrene is a natural result of the interruption of the circulation, consequent upon the formation of the carcinomatous matter in the blood-vessels. In the soft varieties, especially, enormous sloughs sometimes separate; and instances have occurred, in which the whole diseased structure has thus been destroyed and thrown off, with the effect, it is said, of saving the life of the patient. It is generally admitted that cancer is liable to inflammation and suppuration; but these results are rare in the genuine carcinomatous structure; and, when observed in connexion with the disease, are probably most frequently situated in the surrounding or invaded normal tissue. Some believe that carcinomatous structure occasionally undergoes a calcareous transformation, and thus loses its malignant character. Dr. Bennet has met with cases which he considers as affording conclusive evidence of this fact; and Rokitansky not only admits this mode of spontaneous cure, but another also, called saponification, by which the matter of the cancerous cells is converted into fat, and forms emulsive or saponaceous compounds. But even those who believe in these modes of cure, admit that they are extremely rare; and, according to Lebert, allowing that a cancerous tumour may perish, or be destroyed, the disease always exists, and will sooner or later give rise to new tumours, unless prevented by the death of the patient from some other cause.

Seat.—Every organ, and almost every tissue of the body, are liable to become the seat of cancer. Certain parts are more apt to be affected than others; as the female mamma, the uterus, the stomach, and the testes. But the disease occurs also in the bowels, especially the rectum, in the œsophagus, the lungs, the liver, the kidneys, the brain, the eye, the tongue, the lips, and the lymphatic glands. Of the tissues, the cellular is most frequently attacked; the skin and mucous membranes are often affected; and the complaint is occasionally met with in the muscular, the vascular, and the bony structures. It seldom seizes on the proper fibrous tissues, or cartilages. Though the veins are readily attacked, the arteries appear to resist it considerably. It is sometimes confined to one part or organ, sometimes occurs in several at the same time. It is not, however, often met with in the same organ on both sides of the body. In females it is more frequent than in males, occurring in the former more especially at the period when the catamenia cease, and in the latter between the ages of 30 and 50. When it occurs in early life, it seizes most frequently upon the absorbent glands, the large joints, or the cellular tissue, and seldom upon the stomach, uterus, or mamma. From statistical researches by Dr. John Le Conte, it would appear that carcinomatous affections become relatively more frequent with increasing age, that women are more liable to the disease than men in the ratio of three to one, and that, in relation to the organs affected, the uterus is most liable, the stomach next, then the mamma, the liver, &c. (*South. Med. and Surg. Journ.*, May, 1846.)

Symptoms and Effects.—The shape, consistence, and situation of carcinoma have been already referred to. It is usually attended with pain at some period of its progress, though this symptom is exceedingly irregular. Not unfrequently, especially in the internal organs, it has made very great advances before producing any considerable uneasiness. The characteristic pain of carcinoma is sharp and lancinating. Without any apparent cause, the patient, previously quite easy, feels upon a sudden an acute, sometimes excruciating pain, shooting through the part affected, and then ceasing for a time. But this is not experienced in all cases; nor is it confined to cancerous diseases, being a frequent form of neuralgia. It is when ulceration has extended to the surrounding tissues, that the patient suffers most; and now the pains are often exceedingly distressing. In the commencement, the pain frequently intermits. Towards the close, it may become almost constant, though still liable to remissions.

The system always becomes affected in advancing carcinoma. It is said that a disposition to the disease is marked by a cachectic condition; but this is certainly not always the case; as cancer very often commences in the midst of apparent health. When the disease has advanced so far as to involve the system, the patient generally has a peculiar wan, sallow paleness of complexion, which, with an expression of sadness, is almost characteristic of carcinoma. Disordered digestion, general weakness, and emaciation are also common attendants upon the cancerous cachexia; but, in some cases, a considerable fulness of habit is maintained, even to the close of the complaint. In the advanced stages, the pulse is generally quickened, and febrile symptoms appear.

In the regular course of carcinoma, the patient may sink under the exhaustion from pain, general irritation, excessive discharge, sloughing, &c.; but more frequently the disease terminates by interfering with the function of some organ essential to life, as of the stomach, lungs, brain, &c.; and most of the symptoms which it produces have their origin in the same source. These will be considered most conveniently under the head of special diseases of the organs. It not unfrequently terminates life by eroding the large blood-vessels. The same effect results more slowly by the closure of certain passages, as of the œsophagus, pylorus, intestines, &c. By compression or obliteration of the blood-vessels, it sometimes occasions venous congestion, and consequent dropsy. Thus, carcinoma in the liver gives rise to ascites, by impeding the portal circulation; and in the pylorus, duodenum, ovary, and uterus, to dropsy of the lower extremities, by interfering with the return of blood through the great veins. It has a strong tendency to occasion coagulation of the blood in the neighbouring veins, and sometimes gives rise to a kind of phlebitis, which has the same effect. When the veins which carry the blood from the exterior parts of the body are thus affected, œdema of these parts is apt to occur, and sometimes also a tense elastic swelling of the areolar tissue, bearing considerable resemblance to that of the milk-leg in women. I have seen two cases of this kind of tumefaction, in one of which the lower extremities were much swollen, tense, and elastic, in consequence of phlebitis of the iliac veins and vena cava connected with cancer of the liver; in the other, the neck, anterior and posterior part of the chest and the right arm were similarly affected from an extensive medullary cancer in the anterior mediastinum. Lebert thinks that death in cancer usually results, not from these secondary effects, but from a direct depravation of the blood, rendering it unfit for the support of the vital functions.

The blood contains a diminished proportion of red corpuscles, and in the advanced stages is found, after death, either liquid, or in soft coagula, very different from those observed in health. The heart and muscular tissue generally are soft and fragile, as are also the bones; and the viscera are, for the most part, remarkably bloodless. Evidences of pneumonia are not unfrequently noticed in post-mortem examinations. (*Lebert.*)

The duration of the disease is extremely variable. While in some very rare cases it runs its whole course in two or three months, it continues in others for ten or even twenty years. The mean duration is different in different organs. Cancer of the viscera is more speedily fatal than that of external parts. Thus, cancer of the stomach and bowels runs its course, on the average, in from thirteen to eighteen months, while that of the mamma has a mean duration of about forty-two months. The character of the tumor also has great influence over its course. The soft cancers are usually much more speedily fatal than the hard.

Diagnosis.—The diagnosis of external cancer belongs to surgery, that of the disease occupying internal organs, to the department of special diseases; as the symptoms by which it is to be recognized, if at all, are chiefly those connected with the deranged functions of the organs respectively. The practitioner, however, may be aided in forming his judgment by certain general considerations. The lancinating character of the pain, though by no means to be relied on, may be of some use in the diagnosis. The obstinacy of the disease, which resists all curative measures, and in general marches steadily onward, will also be taken into view. Another circumstance of importance is the peculiar cachectic appearance of the complexion, to which allusion has been already made.

Occasionally, the tumour can be felt through the walls of the cavity containing it; and, when this is impossible, the practitioner may sometimes avail himself of percussion and auscultation with advantage. But the diagnosis is almost always more or less uncertain, when the tumour cannot be felt or seen. When the opportunity is offered of examining portions of the cancerous tissue by the microscope, a correct conclusion can generally be formed as to its nature. Dr. Bennet lays much stress on the coexistence of a fibrous tissue and the cell-structure already described, as a means of diagnosis. He does not consider the cells alone as sufficiently distinctive. It is true that a satisfactory conclusion cannot be drawn from a single isolated cell; but, in the aggregate, they are quite characteristic. Their great size, particularly that of the mother-cells; the unusual relative magnitude of their nuclei and nucleoli, and the extreme diversity of their form, give to them in mass an appearance which is presented in no other structure than the carcinomatous. A variety of cancerous formation is sometimes met with, bearing so close a resemblance to the yellow tuberculous masses that the unaided eye is unable to distinguish them. By the aid of the microscope, however, the cancerous cells are seen, and at once determine the nature of the tumour. This peculiar aspect is attributable to the production of yellow fatty matter.

Other morbid formations, very analogous to carcinoma, not only in the appearance of the tumours after death, but to a certain extent in their course and results in the living subject, are those denominated *cancroid*. These are tumours of the skin and mucous membranes, consisting of an excessive production of epidermis or epithelium, having, like cancer, a tendency to extend into neighbouring tissues, and to ulcerate; and, like it also, capable of destroying life. But they are not attended with, and do not produce any infection of the system; if extirpated or destroyed, do not necessarily return in other parts of the body, and are therefore curable. Under the microscope, they exhibit no cancerous cells, but appear to be made up mainly of papillæ and epidermic, or epithelial cells, according to their position.* The *hard fibrous*

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* *Cancroid*, Lebert.—*Epithelial Cancer*, Paget. Mr. Paget considers this variety of tumour as having all the malignant qualities of carcinoma, though in a less degree. It has a similar disposition to invade the neighbouring parts, is prone to ulceration, is apt to return after removal, is repeated or propagated in other parts, is attended with a vitiated condition of the system at large, and, after being once established, generally goes on to a fatal issue. He does not hesitate, therefore, to rank it with the cancerous affections. It is usually simple, and seated in or immediately beneath the skin or mucous membranes, but in some rare instances is deeper seated, and appears to have no connexion with these tissues. Its most common position is in the lower lip. The essential character of the tumour is that it consists chiefly of cells resembling those of the epithelium or epidermis, infiltrated into the proper tissue of the part affected. The papillæ, being included and enlarged, often give it a condylomatous or warty appearance. It has no distinct basis-structure of its own; the peculiar cells being supported by the original tissue. The outline of the flattened cells is much diversified, sometimes fantastically so. Their diameter varies from $\frac{1}{200}$ to $\frac{1}{1200}$ of an inch. The nucleus is usually single, central, and small; and the surrounding contents of the cell, clear or slightly nebulous, with a few minute granules interspersed. Some of the cells, probably the younger, are smaller, rounder, and more regular; others exhibit various appearances of degeneration. Besides these characteristic cells, there are 1. free nuclei, 2. endogenous cells containing one or more nuclei, appearing as if developing into cells; and 8. very large *laminated capsules*, oval or roundish, from $\frac{1}{100}$ to $\frac{1}{500}$ of an inch in diameter, very thin, closely compacted, and containing granular matter, and nuclei or cells obscurely visible. The ordinary cancer-cells are not found in these tumours. They have been ascribed to an excessive production of epithelial or epidermic cells: but Mr. Paget thinks that they are a peculiar growth, and that their characteristic cells are merely imitations of those of normal epithelium. This form of cancer, however, beginning later in life than the other forms, advances more slowly, is less apt to multiply, and

structures resulting from chronic inflammation have sometimes been mistaken for scirrhus, and have, by some pathologists, been thought capable of taking on the cancerous character. But they are rather elastic than of the stony hardness of scirrhus; are usually smooth, instead of knotty on the surface; do not extend themselves into neighbouring organs; never contaminate the system, and never exhibit cancerous cells. When indurations, supposed to be inflammatory in their origin, have afterwards exhibited the carcinomatous character, they have, in all probability, had this character from the beginning. Several of the *organized non-malignant tumours* enumerated in page 121, might be confounded with the cancerous upon a superficial examination, but differ from them essentially not only in their microscopic characters, but in their comparatively innocent nature. Thus, though some of these tumours are apt to return after removal, yet for the most part it is in the cicatrix of the old, leaving room for the supposition that the extraction had been incomplete. Again, it is not very uncommon to find several tumours of a particular kind in the same or different parts of the body; but this arises from special tendencies of the system or diatheses, leading to special products, and not from the propagation of disease from one original point, and is not accompanied with the carcinomatous depravation of health. It must be acknowledged, however, that tumours are occasionally met with, having a precise resemblance to those considered innocent, both in external and microscopic characters, and in which no cancerous cells can be discovered, which nevertheless run in all respects the course of carcinoma, and with no less malignancy. The pathology of cancer, therefore, though it has of late years been greatly advanced, cannot be considered as definitively settled.

Nature and Mode of Developement.—The minutest speck of carcinomatous growth, at the earliest stage in which it is susceptible of examination, has all the microscopic elements which are detected at a later period. Yet it cannot be admitted as possible, that the large cancer cells should have passed from the blood through the walls of the capillaries, in which no opening, however minute, can be seen. It is inferrible, therefore, that the carcinomatous matter must originally exude from the capillaries in the state of a uniform liquid, a minute particle of which, being deposited in the midst or on the surface of a living tissue, immediately takes on, through its own vital force, the characteristic organization of cancer. New exudation around the little tumour undergoes a similar organization, and thus the disease gradually spreads, incorporating the original tissue, or causing it to disappear through absorption, occasioned probably by pressure. At this stage of our investigation we are met by the questions, whence is derived the tendency to this abnormal organization of the exuded matter? and through what agency is the tumour increased, whether by the inherent quality of the exudation, or by some influence exerted upon it by the morbid structure already formed? The answers to these questions, in the present state of our knowledge, must be somewhat speculative.

First, in relation to the tendency to abnormal organization in the exudation, it may be said that invisible cancerous germs exist in the blood, which, being thrown out with the fibrin, undergo developement into cells and fibres. The idea has been entertained that the cancerous matter is formed in the blood, and Dr. Carswell maintains that it is often seen in the veins, either

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less frequently affects the interior organs. Besides, it in a less degree impairs the general health; and cases have occurred in which a permanent recovery has followed extirpation. For more precise details upon this subject, the reader is referred to Mr. Paget's *Lectures on Surgical Pathology*, in which the whole subject of tumours is treated in a masterly manner.—*Note to the tenth edition.*

loosely connected with their inner coat, or quite free from attachment, and having all the characters which it exhibits when observed elsewhere. To the inference drawn from this fact it may be objected, that the cancerous matter may have been absorbed into the veins from some contaminated source. But Dr. Carswell meets the objection by the assertion, that it sometimes exists in the veins when no carcinomatous disease can be found in any other situation, showing that, in these instances at least, it must have originated in the blood. It is seen only in the veins and capillaries, because, if formed in the arteries, it is carried forward, by the movement of the blood, to points where the current slackens, and allows it to be deposited. Dr. Walshe, however, states that out of a vast number of post-mortem examinations, conducted by skilful men of all nations, he has never seen or heard of one, and found no one detailed in periodical works, confirmatory of this assertion of Dr. Carswell; and Lebert states that cancer cells are never found loosely floating in the blood, being either connected with excrescences formed on the inner surface of the veins by exudation, as elsewhere, or, when they have entered the veins by erosion, being prevented by the coagulation of the blood from travelling beyond a certain distance in the vessels. The notion, therefore, of proper cancerous structure existing in visible forms in the blood, must be given up. It can only be in the state of invisible germs that that fluid can contain the carcinomatous matter. But whence these germs? Have they proceeded from the parent; have they been derived from external sources and found entrance into the circulation along with the results of digestion; or have they been elaborated in the processes which contribute to sanguification? These questions cannot be answered in the present state of our knowledge. Indeed, there is no certainty that any such germs do pre-exist in the blood. In favour of this idea is the fact, that cancer often originates at numerous points often far separated; but against it is the other fact, still more frequently observed, that the tumour may be quite solitary. It may be that, in the cancerous constitution, certain tissues have the power to elaborate cancerous structure out of healthy exudation; and, in favour of the idea that some influence of this kind is exerted by tissue, is the well-known predilection of the disease for certain localities, such as the mamma and uterus. Upon all these points we must wait for further light from observation.

In relation to the second question, as to the agency through which the tumour, when once originated, is subsequently propagated, there is also room for difference of opinion. Some believe that the cancer cell, being once formed, has the power of self-propagation, requiring only nutriment from the blood. But this opinion is opposed by the result of experiment, which has never succeeded in producing cancerous tumours by transplantation. Dr. Joseph Leidy, of Philadelphia, observed a vascular connexion to take place between a portion of cancerous tissue, inserted beneath the skin of a frog, and the neighbouring parts, proving the existence of an independent vitality in the former; but, on examining the tumour subsequently, instead of finding an increase of cancerous cells, he observed that those pre-existing in the inserted structure had disappeared, and that fibrous tissue only remained. (*Proceed. of Acad. of Nat. Sci.*, May, 1851, p. 201.) The inference would appear to be, as maintained by Lebert, that each increase of developement takes place in the newly exuded matter through its own inherent powers. Nevertheless, that the tumour already formed exercises some influence in contributing to the additions made to it, and in the further extension of the disease, would seem to be proved by the much greater tendency to the formation of cancer about a carcinomatous centre already existing, than elsewhere, and by the well-known disposition of the affection to extend from one of these centres through the absorbents to lymphatic glands at considerable distances, which is best explained upon the supposition of the conveyance of germs from the part first affected. The ultimate infection of the whole system, if it be referred to existing tumours, and not to an increase of the morbid state of system which originally led to the formation of these tumours, can be explained only by a similar conveyance of germs from the diseased centre into the blood.

Some difference of opinion has existed in reference to the origin of the fibres in cancerous tumours. As these are found most abundantly in tumours occupying tissues normally fibrous, some pathologists have been disposed to consider them as the result of simple hypertrophy of the natural fibrous structure. Dr. Paget is convinced that the fibrous ingredient of carcinomatous tumours of the mamma, in the great majority of instances, is only that which belongs properly to the breast. (*Lect. on Surg. Pathol.*, ii. 304.) But fibres sometimes also exist abundantly in tumours occupying tissues destitute of this structure, or but scantily supplied with it; and the probability is, that they are for the most part formed out of the same exudation or blastema as the cells, and by the same inherent formative force.

Another question, in relation to the origin of carcinoma, is whether it can be propagated by contagion. Opinion has generally been opposed to this idea. An experiment of Langenbeck favours it. He injected cancerous matter into the veins of a dog, which was killed some weeks afterwards, when carcinomatous growths were discovered in the lungs. Dr. Watson states that he has known of two instances in which cancer of the penis occurred in men, whose wives laboured under the same disease in the uterus; and other cases of a similar kind have been since reported. (See *Lond. Med. Times and Gaz.*, Jan. 1854, p. 71.) Facts, however, on this side of the question, must be much more largely accumulated, before it can be decided in the affirmative. I have never myself known an instance of the propagation of cancer by contagion. Such a result, however, would be in accordance with the notion of the origination of the disease in peculiar germs. Such germs transplanted to another body, might be supposed readily to adapt themselves to their new position, and there to grow and propagate. It has been already stated that such a transplantation may possibly occur from one part of the same body to another part, and that thus the extension of the disease to distant organs may be effected. At all events, if this be the case, a peculiar condition of system, a certain morbid diathesis, must exist, essential to the growth of the new germ, and without which it would be dormant or perish. This diathesis is probably sometimes inherited. Of its causes and essential nature, we are quite ignorant.

Cancer has by some been supposed to be a parasitic animal; but strongly in opposition to this notion is the well-established fact, that many of the lower animals are liable to the same disease; whereas parasites are generally peculiar to the species of animal in which they are found.

Varieties of Carcinoma.—The varieties of carcinomatous disease may be arranged into three groups, characterized severally by certain distinctive qualities of consistence, growth, &c. These are 1. *scirrhus*, 2. *medullary carcinoma*, and 3. *gelatinous cancer*.

1. *Scirrhus.*—*Carcinomatous Sarcoma* (Abernethy).—*Stone Cancer.*—This is characterized by a hard, whitish, gray, or bluish-white, semi-transparent substance, presenting when cut a shining surface, and often intersected by opaque, white or pale straw-coloured bands of fibrous, or condensed cellular tissue. Sometimes it has a decidedly lobulated arrangement like that of the pancreas, and, when of this character, was called *pancreatic sarcoma* by

Abernethy. Sometimes its appearance closely resembles that of boiled pork, whence the name of *lardaceous tissue*, applied to it by the French writers. The fibrous tissue predominates in this variety.

Scirrhous tissue is very dense and hard, with a stone-like feel, and yields a peculiar creaking sound when cut with a sharp knife. In its perfect form it yields very little cancerous juice on pressure; and it is best prepared for microscopic examination by being scraped with a knife, so as to be reduced to a pulpy state. It is more frequently than the other varieties attended with the peculiar lancinating pain of carcinoma. Few blood-vessels can be detected in it. Its growth is usually slow, and not unfrequently many years elapse before it terminates. It seldom attains a greater size than that of an orange. (*Walshe.*) It is apt to contract adhesions to neighbouring structures, which is clearly seen when it is situated beneath the skin. In this case, the skin unites firmly with the tumour, and at the same time shrinks considerably. This contraction of the neighbouring tissues is one of the characteristics of scirrhus. When softened, it is converted, according to Walshe, into a yellowish-brown, semi-transparent, jelly-like matter. Scirrhus is often solitary; only one tumour existing in the body at the same time. It is most frequently seated in the breast; and is less apt than the following variety to attack different parts of the body. Hemorrhage within its structure, or from its ulcerated surface, is less frequent than in the soft carcinoma. Scirrhus seldom occurs before puberty, and is most common in advanced life.

2. *Medullary Carcinoma.—Medullary Sarcoma* (Abernethy).—*Encephaloid Disease.—Cerebriform Disease.—Fungus Hæmatodes* (Hey).—*Soft Cancer.*—This consists of a dull-white, opaque, softish matter, bearing a considerable resemblance to brain, with a lobulated arrangement. Hence the names of *encephaloid* and *cerebriform* disease employed by French writers. It owes its consistence to the predominance of the proper carcinomatous cells. The carcinomatous tissue contains, in this variety, numerous minute blood-vessels, the coats of which are very delicate, and easily rupture, giving rise to frequent hemorrhage, both within the tumour, and from its surface after ulceration. Hence the tissue acquires a bloody appearance; from which circumstance, as well as from its tendency to sprout rapidly out through the skin, after this has been opened, Hey was induced to give it the name of *fungus hæmatodes*. In some rare instances in which the arteries are very numerous, and the tumour is seated in or upon bone, and bound down by fibrous tissue, a full soft pulsation may be felt in it. (*Paget.*) Sometimes the tissue has greater firmness, resembling considerably a section of the boiled udder of a cow, whence it was called *mammary sarcoma* by Abernethy. When the *vascular sarcoma*, of the same author, assumes a malignant character, it must be ranked with this variety of carcinoma. Other names have been given to varieties of the tumour, from certain supposed resemblances to objects in nature, as the *solanoid*, from its resemblance to the potato, &c.

In all its forms, medullary carcinoma is less hard and dense than scirrhus. It is often of very rapid growth, sometimes attaining its full size in a few weeks, and advancing with especial rapidity after ulceration. It sometimes attains an enormous magnitude. It is not apt like scirrhus to contract adhesions, and, when beneath the skin, causes this tissue to ulcerate by distension and pressure, rather than by communicating its own nature to it. When softened, it has a white, opaque, creamy appearance. (*Walshe.*) It is in this form of carcinoma, that the peculiar matter of the disease is most frequently found in the veins and absorbents. The disease often exists at the same time in different organs, and there is scarcely a portion of the body in which it has not been found. It is very apt to occur secondarily to the preceding form of cancer. It occurs most frequently in the young, and often before puberty.

3. *Gelatinous Carcinoma.—Colloid Cancer.—Areolar Gelatinoid Cancer* (Cruveilhier).—*Gum Cancer.*—This consists of a jelly-like, transparent matter, usually of a yellowish, or greenish-yellow colour, sometimes grayish, brownish, or reddish, which, when separated from the tissue, is soft, but, as found in the tumour, has considerable firmness. It is contained in a vast number of loculi or cysts of various size. This variety of cancer may exist alone, or as a part of other cancerous tumours. It seldom occurs in more than one organ at the same time; and hitherto has been observed chiefly at the pyloric orifice of the stomach, in the omentum, and the intestines; though it has also been seen in the bones, testis, and mamma. It is very rare in youth. Lebert states that gelatinous tumours resembling the carcinomatous in appearance sometimes occur, which do not exhibit any of the true cancer cells, and are therefore not entitled to be considered as carcinomatous.

Cause of Carcinoma.—Of the cause of cancer we know nothing, except that it sometimes appears to be hereditary, and occasionally makes its appearance at such a period after local injuries, as to justify the inference that the injury has served to call a pre-existing tendency to the disease into action.

Treatment of Carcinoma.—The treatment of external cancer belongs to surgery. That of the internal disease is simply palliative. Three indications are presented: 1. to relieve pain, 2. to support the failing strength, and 3. to obviate as far as possible the effects of the tumours upon neighbouring organs, and on the function of those they occupy. The first indication is to be met by narcotics, of which opium is by far the most efficacious; but others, as conium, hyoscyamus, stramonium, belladonna, &c., may be occasionally substituted with advantage; the great principle being to husband the susceptibility of the system to the operation of these anodynes, so that they may not too soon lose their effect. Hence they should at different times be applied in different modes, as by the stomach, rectum, or skin; and one should now and then be substituted for another. The second indication is usually better fulfilled by the use of a nutritious, easily digestible diet in the advanced stages, than by stimulation. It is said that cod-liver oil, alternated with chalybeates, has been found useful in anemic cases. As to the measures calculated to obviate the effects of the tumours, these will be most conveniently treated of under the heads of diseases of the several parts respectively in which the cancer may be situated.

c. Parasitic Animals.—Entozoa.

Strictly speaking, these may be regarded rather as causes of disease, than as pathological conditions; but, in the present uncertainty as to their origin, it may not, perhaps, be amiss to consider them among those morbid products, which, in the absence of any precise knowledge of the real disease in which they originate, are by common consent placed in the rank of diseases. They are characterized by having an independent life of their own, with the power of reproduction or generation; and depend on the system only for convenient quarters and suitable nutriment. Almost every species of animal has its own peculiar parasites, and man is not an exception to the general rule. There is scarcely a portion of the human frame which has not served as the dwelling of one or more of them; and it has been observed, that certain species have a peculiar predilection for certain organs, which they sometimes exclusively inhabit.

In relation to their mode of origin, pathologists have long been divided between two hypotheses; one of which maintains that they are derived from distinct germs or ova, the product of preceding animals of the same species; the other, that they are the result of spontaneous or equivocal generation, in other words, spring into existence without parents, through some action going on within the system. Recourse should be had to the latter opinion, only upon satisfactory proof of the insufficiency of the former. The course of nature, so far as it can be observed, is so uniform in the propagation of living beings by others of the same specific character, that, when any uncertain case is presented, we are bound by a correct philosophy to refer it to the general rule, unless this can be shown not to be applicable. But no such inapplicability can be proved in the present instance; nor are there any difficulties which do not admit of explanation. Supposing the entozoa to have the same origin as other living beings in general, their germs must be derived from one of two sources; either they must have been received from the parent, and thus pre-existed in the body from birth, waiting for circumstances favourable to their developement, or they must have been derived from without. In favour of the former notion is the fact, that each species is confined, as a general rule, to a particular animal, like a plant to certain districts of country. But the explanation of this fact simply is, that the germ finds only in the particular animal in which it flourishes the condition of things favourable to its vital activity. A strong argument against the opinion is the difficulty of supposing that the ovum or germ should have so long remained concealed in the same individual and his predecessors, possibly for many generations, without undergoing developement. The probabilities are greatly in favour of its external origin. It is said that the parasitic animals of the human frame have no prototype in nature. This is true of most of them, so far as observation has extended. But, in the first place, the fact that no such prototypes have been discovered is no proof of their non-existence; and, secondly, animals of the same species as the parasite may be constantly before us in the outer world, but with characters so different that they cannot be recognized. It is highly probable that living beings, developed from ova in the human body, would be so modified by the peculiar circumstances of their position as to lose specific characteristics, which naturalists ordinarily deem essential. The eyeless fish of the Mammoth Cave of Kentucky are said, by persons quite competent to decide, to be identical with those in the ordinary streams of the country. If an animal can thus, in its developement from the ovum, lose an eye where it is not wanted, it may well lose other less important characters of mere form. It may well be, therefore, that of the innumerable germs which fill the external world, some may find admittance into our frames, and there expand into beings apparently different from anything around us. But it has been objected, further, that not only are these parasites found in parts of the frame having an external communication, but also in closed cavities, in the interior of parenchymatous organs, and even in the fœtus. In reply, it may be said that wherever a blood corpuscle can circulate, there also may pass a living ovum; for germs much smaller than that corpuscle have within them the powers requisite for organization. Microscopic germs may enter our systems through the lungs or stomach, and circulate everywhere with the blood, and even pass along with nutriment into the fœtus, though larger in proportion to the resulting animals than an acorn to the oak. A positive argument in favour of the opinion here advocated is the occurrence of certain entozoa only in certain regions of country. Thus the Guinea worm is known only in certain parts of the East; and, of the two species of tapeworm, one is confined chiefly to certain parts of Europe, where the other is comparatively little known. (See *Intestinal Worms.*)

Symptoms and Effects.—The presence of parasitic animals, when lodged in situations whence they cannot escape, and where they cannot be seen or felt, can be known only by their effects. Sometimes they escape from situations communicating externally, as from the stomach, bowels, and bladder, and are then readily recognized, often when only in fragments. If in the humours of the eye, they may be seen, though such an event is exceedingly rare. When superficial, or of great magnitude, they may sometimes be felt through the integuments. In the natural cavities, where they can move freely, they often occasion discomfort and derangement of function by their motions. This happens especially in the alimentary canal. Wherever they may be situated, acting as foreign bodies, they are liable to produce injury by their bulk, exciting irritation, if not inflammation of the surrounding tissues, and giving rise to all the consequences heretofore alluded to as the result of the compression of organs, or the obstruction of passages, ducts, and blood-vessels. Sometimes the enormous magnitude they attain occasions, of itself, great inconvenience; as in some cases of encysted dropsy. Another source of mischief is their occasional rupture from over-distension, and the effusion of their contents into the tissues or cavities of the body. They are liable, moreover, themselves to disease, as for example, to inflammation, which may occasion suppuration, ulceration, change of structure, &c., and involve the system in a state of great local and sympathetic disturbance. In some instances, moreover, in which they are very numerous, or of great size, they divert from the system a portion of the nutriment essential to its support.

In some situations, especially in the brain, they are productive of great mischief by immediately interfering with the functions of the organ. In the stomach and bowels, too, they are often very injurious, not only by their direct effects, but through the various sympathies which connect the alimentary canal with other parts of the body. Sometimes they produce great destruction of the organ in which they reside merely by their pressure. An instance is on record, in which the whole parenchyma of a kidney was thus destroyed by the presence of a *Strongylus gigas.* But the various phenomena produced by them, in particular localities, belong to the department of special diseases.

It will be proper here to state that, in the solid structures, the mischief which they might produce is generally much obviated by a provision of nature, which surrounds them with a cyst of condensed cellular tissue or false membrane, which serves to isolate them, and thus limits the resulting inconvenience chiefly to their bulk. As they often grow very slowly, the organ becomes accustomed to the gradually increasing pressure, and suffers, in general, less inconvenience than might be supposed. Sometimes, moreover, they never attain a considerable magnitude, and consequently produce few or no observable effects. Thus the Trichina spiralis, which is almost microscopic, sometimes inhabits the muscles in great number, without apparently interfering with the action of these organs, or with the general health in any way.

Causes.—Of these, except in the case of worms in the bowels, which will be treated of distinctly, we know little or nothing. It has been supposed that living in a warm damp atmosphere favours the production of the parasites. Certain kinds of food and drink have been accused as the cause of their developement. It has before been stated that some of them appear to be confined to certain districts of country, from which it may be inferred that exterior influences are not without effect. A feeble cachectic state of health frequently attends them; but it is often impossible to say how far this may have served as the cause, and how far it may be a mere effect. It is highly probable that a certain condition of system is generally favourable, or necessary to their developement; as their occurrence is comparatively rare, while there is no reason to suppose that all may not be exposed to the entrance of their germs or ova.

Varieties.—These parasites are found of every grade of organization, from the lowest possible, up to one of considerable complexity; and have been ranked by naturalists in distinct classes, genera, and species. In the following sketch, I follow very nearly the arrangement of Mr. Owen, as modified by Dr. Farre in *Tweedie's System of Practical Medicine.*

CLASS 1. *Hydatids.*—*Psychodiaria.*—The first class is denominated *Psychodiaria*, and includes the parasites usually called *hydatids*. They consist of a laminated globular sac, containing a transparent liquid, and are among the simplest of all living beings. They are nourished by imbibition. Two genera are included in the class; one, called *Acephalocystis*, signifying a cyst without a head, and distinguished by the generation of germs between the layers of its tunic, and their developement like buds upon the inner and outer surface; the other, *Echinococcus*, the characteristic peculiarity of which is, that it contains minute and very singular parasites, of a different form from its own, either attached to its inner surface, or floating in its cavity. Of the Acephalocystis there are two species, distinguished from each other by the reproduction occurring, in the one, upon the inner, and in the other, upon the outer surface. The former, named *Acephalocystis endogena*, is the common hydatid of the human body; the latter, *A. exogena*, occurs in the inferior animals. A specimen, however, of the A. exogena is described by Dr. Farre, as having been taken from the brain of a coloured man in Barbadoes.

Acephalocystis endogena.—The common acephalocyst, or hydatid, is a globular membranous sac, composed of distinct layers, sometimes opaque, sometimes nearly transparent, having a smooth surface externally, but somewhat unequal internally, and containing a limpid colourless liquid, which is said to have albuminous and gelatinous properties. A cyst formed from the neighbouring tissue usually surrounds it. Its nourishment takes place by imbibition, and its young are produced like buds upon its inner surface, from which they separate, and float in the contained liquid. The hydatid is found of every size, from that of a hemp-seed to that of an orange, or even a child's head. The larger usually contain vast numbers of younger hydatids, of all sizes, which again contain others within themselves, and the whole sometimes amount to thousands.

The cysts about them are liable to inflammation, and various degeneration, and occasionally secrete pus or other liquid, in which the hydatids float. Sometimes they are very thick and rugged, as in the liver; sometimes thin and delicate, as in the brain, where they are occasionally quite wanting. The cyst is always single, however numerous may be the hydatids it encloses, proving that they all sprang from one original parent. In fact, the lining of the cyst may be considered sometimes as the original hydatid, which has contracted adhesions with the enclosing sac.

Hydatids, like other animals, are liable to perish. In such a case, their liquid matter is absorbed, their tunics collapse upon each other, and a tumour is formed, in which atheromatous, sebaceous, or tuberculous matter, is occasionally intermingled with the membrane.

Their usual abode is in the parenchymatous organs, but they have occasionally been found also in the serous cavities, and even in the blood-vessels. They most frequently infest the liver, next the lungs, ovaries, spleen, kidneys, brain, &c.; and occasionally almost all parts of the body. Andral met with a hydatid in the blood of the pulmonary vein. Connected with the ovaries, and with different contents of the abdomen, they sometimes occasion encysted dropsies of enormous magnitude; at least, dissection, in such cases, reveals occasionally a great number of irregular cells, containing hydatids in different stages of their growth.

Echinococcus.—This differs from the acephalocyst chiefly in its yellowish and tougher outer coating, and in containing, as before stated, numbers of a minute parasite, of an apparently different genus from itself. These animalcules, which are about the $\frac{1}{80}$ of an inch in length, are sometimes uncovered, and sometimes have a distinct cyst of their own. They have a head, around which is a circlet of hooks, enabling them to attach themselves to the inner surface of the sac. Their structure would rank them with the following class. The echinococcus inhabits the liver, spleen, omentum, brain, &c. Müller relates a case in which one of the genus was discharged with the urine. This hydatid may be smaller than a mustard seed, or larger than a pigeon's egg; and numbers of them are sometimes found clustered together. There are no symptoms by which they can be detected during life.

CLASS 2. *Sterelmintha.*—"These consist of a solid parenchymatous texture, in which are excavated, as it were, the canals or cavities which serve the purposes of digestion. They have no separate tegumentary system. They have but one opening to the alimentary canal, and the sexes are placed upon the same individual." (*Farre.*) The genera belonging to this class, which appear to merit attention, are *Cysticercus*, the animalcule of *Echinococcus*, *Tænia*, *Bothriocephalus*, and *Distoma*. Of these, Tænia and Bothriocephalus will be treated of with other intestinal worms; and the animalcule of Echinococcus has been sufficiently noticed above.

Cysticercus.—This parasite has a nearly cylindrical, or slightly depressed body, ending in a caudal vesicle, and having a small roundish head upon a slender neck. The head is crowned by one or two rows of small hooks or recurved spines, by which it is enabled to attach itself to soft objects near it; and placed around it are four suckers, which are the mouths of the animal, through which it receives nourishment. The caudal vesicle contains a limpid serum, and has caused the animal to be commonly ranked with the hydatids. The cysticercus is capable of an undulatory movement, of advancing or retracting the head, and expanding or contracting the caudal vesicle. It is always surrounded with an adventitious cyst. The different species of this parasite are not unfrequently found in the lower mammiferous animals. Some of them are occasionally met with in man, occupying the muscles, the brain, or the eye. But they are very rare. Their symptoms are quite obscure. Sometimes they occasion no unpleasant effects whatever. M. Renaud mentions two cases, in one of which the parasite was found in the brain, in the other in the substance of the heart, without producing, during life, any observable disorder in the functions of these organs.

Distoma. Liver-fluke.—The body is yellow or light-brown; ovate, elongated, flattened, and somewhat pointed at each end; and supplied with three apparent pores on its under surface, the posterior intended for adhesion and locomotion, the middle for generation, and the anterior for nourishment. This animal is very common in the gall-bladder and biliary duct of the sheep, and is occasionally found in the same situations in man. It is supposed to feed upon the bile, or the mucus of the biliary passages and gall-bladder. It produces no symptoms by which it can be recognized, but has been sometimes discharged from the bowels.

CLASS 3. *Cœlelmintha.*—These are hollow cylindrical worms, having a distinct alimentary canal with its own proper walls, a mouth and anus generally at opposite extremities, in most instances a distinct nervous system, and organs of generation on separate individuals. The genera belonging to this class, deemed worthy of notice, are *Trichina*, *Filaria*, *Tricocephalus*, *Strongylus*, and *Ascaris*. Two others, *Spiroptera* and *Dactylius*, are described by Dr. Farre, but have been very rarely observed, perhaps each only in a single case, and both in the urine of females. *Tricocephalus* and *Ascaris* belong to the intestinal worms.

Trichina spiralis.—This species of Trichina is interesting from its extreme minuteness, its great numbers, and its peculiarity of position in the human body, rather than from its morbid effects. It is found in the muscles, to which it gives a gray speckled appearance, as if "thickly sprinkled with the eggs of some small insect." This appearance has been repeatedly noticed in dissections, but was not referred to the true cause until the year 1833, when Mr. Helton detected the presence of animalcules, which were afterwards more accurately described by Messrs. Paget, Owen, and Farre. The animal is contained in cysts, resembling minute white ovate grains, which cannot be distinctly examined without the aid of the microscope. The cyst is about $\frac{1}{50}$ or $\frac{1}{40}$ of an inch long, and a third or half as broad, and consists of an outer and inner coat, within the latter of which may be seen, generally one, but sometimes two, or three minute coiled-up worms. For a description of the worm, the reader is referred to Dr. Farre's essay in *Tweedie's System of Practical Medicine*. These cysts are arranged in the muscle, with their long diameter parallel with the muscular fibre, and firmly adherent to the cellular tissue between the fibres. They abound more in the superficial than in the deep seated muscles, but in persons affected with them, are generally present, in fewer or greater numbers, in almost all the muscles of the body, excepting those of the heart, the stomach and bowels, and the bladder. The cases in which they have been noticed after death, in the dissecting rooms of London, have not been very unfrequent. No evidence has yet been produced of any morbid influence exerted by them upon the system during life. They have been found in subjects carried off by sudden death, in the midst of health.

Filaria.—Several species of this genus have been observed in man. *Filaria medinensis* is the noted Guinea or hair-worm, which is apt to attack the inhabitants of Upper Egypt, Nubia, Guinea, and other intertropical regions of Africa, being developed in the subcutaneous tissue, in various parts of the body, but more especially in the lower extremities and scrotum. It is a very long and very slender worm, being about half a line in thickness, and sometimes as much as twelve feet in length. Every reader of travels must be familiar, from the writings of Bruce, with the effects of this parasite, and its mode of treatment; how it excites an itching or irritation at some point upon one of the extremities; how this is followed by a vesicle or pustule, after the opening of which, the head of the worm appears; by what careful and patient manipulation it is necessary to withdraw the worm, so as to avoid breaking it; and what severe inflammation, with suppuration, and long confinement and suffering, follow this accident, probably in consequence of the escape of innumerable young worms into the wound. This subject, however, belongs strictly to surgery. The *Filaria oculi*, a much smaller species, has been found in the human eye, and the *F. bronchialis* in the bronchial gland; but they are both exceedingly rare.

Strongylus.—It is only the *S. gigas* that is developed in the human subject. It is an enormous parasite, being sometimes half an inch thick, and three feet long, though generally much smaller. The body is cylindrical, tapering towards each end, with circular striæ, and two longitudinal depressions, an obtuse head, a circular mouth surrounded by six hemispherical papillæ, and a tail, which, in the male, is strongly incurved, and ends in a sort of sac. The worm inhabits the kidney exclusively, of which it sometimes produces great destruction, with much pain, bloody urine, &c. Cures have sometimes followed the expulsion of the worm by the urethra; and one case is recorded in which worms were discharged through the integuments of the body, by means of an abscess, and consequent fistulous opening.

Treatment of Parasites.—So far as concerns worms in the alimentary canal, the mode of treatment will be given under special diseases. Surgical methods of management belong to another department of therapeutics. The question for discussion in this place is whether parasites, existing in other parts than the alimentary canal, can be affected by measures applied through the system. It is certain that various substances prove poisonous to them when directly applied; and it is not impossible that they may be reached even through the circulation. Klencke recommends the use of such agents, and mentions cherry-laurel water, camphor, volatile oil of cubebs, oil of turpentine, copaiba, and acetic acid, as having a poisonous action upon hydatids. He employed electricity in one instance, with apparent success, in an individual who passed acephalocysts and echinococci with his urine. One pole of a small galvanic battery was introduced through a glass tube into the bladder, and the other was applied either to the lumbar region, the abdomen, or, by means of another glass tube, to the rectum. Dead parasites were passed about four hours after each application; and the patient was effectually cured. It has been suggested to introduce the current by means of acupuncture needles immediately into the tumour, when this measure is practicable. (*Lond. Med. Gaz.*, Oct. 1846.) It is probable that the death of a parasite, produced in these modes, would be followed by collapse and absorption; but the possibility of the production of severe and even fatal inflammation, especially in cases of great masses of hydatids, should induce caution in the use of directly irritating measures.

CHAPTER II.

CAUSES OF DISEASE.—ETIOLOGY.

WHATEVER is capable of deranging any one of the functions, or any part of the structure of the body, whether it be a form of matter, or merely a quality, condition, or action, is entitled to be ranked among the causes of disease. These, therefore, are exceedingly numerous, and may, indeed, be considered as embracing almost everything in nature, at least everything which is brought in any way into relation with our bodies. Many attempts have been made to classify them. Thus, they have been divided into the *internal* and *external*, the *general* and *local*, the *principal* and *accessary*, the *mechanical* or *chemical* and *physiological*, the *positive* and *negative*, the *proximate* and *remote*, the *predisposing* and *exciting* or *occasional*, &c.; and subdivisions of them have received the names of *occult*, *specific*, *determining*, &c. Most of these terms explain themselves. In relation to some of them, it will be proper to make a few explanatory remarks.

Some have denied that there can, strictly speaking, be any negative causes, and would, therefore, refuse this distinction to cold, abstinence, &c. But the objection is little more than a quibble. A certain diminution of heat, which is called cold, and a reduction in the amount of our daily food, which is called abstinence, are productive of positive, and sometimes very serious effects of a morbid character, and, by whatever name they may be designated, must be admitted to be causes of disease.

It was formerly the custom to consider groups of symptoms as diseases, and the pathological conditions attended by these symptoms, as causes of disease. Hence arose the distinction of causes into the *proximate* and *remote;* the former term being applied to the real lesion, the latter to the cause of the lesion. Thus, in a case of diarrhœa, the discharge being considered as the disease, the inflammation of bowel in which it may have originated was called the proximate cause, and the cold which may have occasioned that inflammation, the remote cause. Now it is evident that the inflammation in diarrhœa is the true disease, and the discharge a mere symptom or effect. The nomenclature, therefore, was inaccurate, and has been generally abandoned by recent writers.

The distinction of *predisposing* and *exciting causes* is better founded. Of the individuals who may be exposed to any particular cause of disease, some will be attacked, while others, though not especially protected, may escape. In the former, there must be a tendency to be affected by the disease, which does not exist in the latter. This tendency is denominated a *predisposition,* and its causes, *predisposing causes;* while the agents which may call the tendency into action are called *exciting causes.* Thus, an individual, exhausted and perspiring after fatigue, is exposed to cold, and attacked with pleurisy. The state of exhaustion and perspiration constitutes the predisposition; the fatiguing exercise, the predisposing cause; and the cold, the exciting cause. But this distinction is by no means absolute. A cause which is exciting in one case, may be predisposing in another. Cold may produce an attack of inflammation, and thus act as an exciting cause; or, by its long-continued influence, may occasion a depression, highly favourable to the developement of some other disease, thus operating as a predisposing cause. Most of the morbid conditions of which the frame is susceptible, may constitute predispositions to other complaints; and the exciting causes of the former, are the predisposing causes of the latter. Nor are these two sets of causes essential in every case. An influence which ordinarily gives rise merely to a predisposition, will often of itself, by a longer continuance, produce the disease to which it predisposes; and an exciting cause may be so active as to produce its effects in persons entirely exempt from any peculiar tendency towards them. While, therefore, this distinction may be admitted, it cannot be adopted as the basis of a classification; for the difference is not in the causes themselves, but in the circumstances of their application; and there are very few agents which may not operate either as exciting or predisposing causes, according to the mode in which they are made to act upon the system.

Specific causes are those which produce exclusively one peculiar disease, which can be produced by no other cause. Such are the several contagions, and certain poisons. There are frequent instances in which a cause produces a peculiar and special effect; but in which this same effect may originate in other ways. Thus, the inhalation of carbonic acid occasions asphyxia, which may result also from drowning, hanging, &c. To such causes Chomel gives the name of *determining.* The name appears to me to belong more appropriately to causes, which, though they may occasion various morbid affections, give rise to one which acknowledges no other origin. I would, for example, call miasmata the determining cause of bilious fever, because, whatever other affections that agent may produce, and whatever other circumstances may favour the production of the fever in question, the operation of miasmata is essential.

To enumerate all the possible causes of disease would be an almost endless task. I shall endeavour first to take a general view of them, and afterward to dwell more at large upon those which, from the extent of their operation, and diversity of their power, require a consideration separate from that of the individual diseases to which they belong.

The causes of disease are either, 1. perversions of the ordinary exterior influences, necessary to the preservation or well-being of the system, 2. excess or deficiency of the actions or processes, in any degree under the control of the will; 3. noxious matters within the body, yet not forming a part of it; 4. derangement of the functions or structure of the system; or 5. agencies, of an injurious character, which have only an accidental relation with the system.

1. It is obvious that, whatever influences are necessary to sustain the ordinary vital functions, must, if excessive, deficient, or perverted, give rise to disorder. Among the influences in question are those of atmospheric air, moisture, temperature, light, electricity, food, drink, and clothing; to which may be added those essential to our moral well-being, consisting of all the relations which connect us with the living world around us. The air may prove hurtful by its impurity, its excessive pressure at great depths, or its levity at great elevations. Moisture may be injuriously deficient or abundant. The temperature may be too high or too low, or may produce disease by its sudden changes. Light and electricity may be too intense for health. Excess or deficiency in the quantity of food or drink, badness in its quality, or a want of due relation between the articles used and the powers of digestion, or the condition of the system in other respects, may severally, or in conjunction, prove sources of disease. Clothing, under which may be included the covering at night, may be superabundant, and thus produce the effects of excessive heat, or deficient, and thus expose the body to still greater injury from cold, or too tight so as injuriously to compress the trunk or the limbs; or may be composed of materials badly adapted to the season, or the peculiar health of the individual. Perhaps we may rank under this head the morbid influence of gravitation, resulting from improper position, or too long a continuance in any one posture. The condition of our exterior moral relations, so powerfully influential over the mental, and consequently the physical health, is subject to constant fluctuations, and, either through undue excitement or undue depression, is very often productive of disease. It would be impossible to specify all the different exhibitions of this morbid cause. They are as endless as are the objects of our affections, wishes, aversions, fears, pursuit, avoidance, or interest of any kind.

2. Scarcely less essential to health than the due influence of exterior physical and moral agents, is that of the processes of our system, which are, to a greater or less extent, regulated by the will. All the functions, in order to be preserved in their normal state, must be properly exercised; and all those which relate to the outer world, must have their due portion of rest. Excess or deficiency, in either of these respects, may be a source of bodily derangement. Hence, we must rank in the list of morbid causes, over-exertion of body or mind; sedentary habits, and mental inactivity; the wear and tear of the passions; neglect of the intimations of hunger, thirst, or other wholesome want of the system, and over-indulgence of these appetites; inattention to the processes of defecation and micturition; and undue prolongation, or loss of sleep.

3. Of noxious matters within the body, yet strictly extraneous to its organization, we have intestinal worms, and other parasitic animals, acid and aëriform products of fermentation in the primæ viæ, acrid or otherwise un-

healthy secretions, retained excrementitous matter, and intestinal, biliary, and urinary concretions.

4. The causes belonging to the division of deranged function or structure are as numerous as these derangements; for there is scarcely a single disease which may not serve as the cause of others. Concatenations of this kind belong to the study of the several diseases. There are, however, certain derangements which are peculiarly prominent in the list of morbid causes, and which may be properly alluded to here. Such are mechanical impediments arising from stricture, compression, or obstruction of narrow passages, as of the alimentary canal, ureter, urethra, and biliary ducts; compression or displacement of vital organs, as the lungs, heart, brain, and abdominal viscera, by tumours or fluid collections; the suppression of habitual discharges, whether healthy or morbid; undue reduction of the mass of blood by bleeding, hemorrhage, or excessive secretion; the transfer of irritation or inflammation from an external to an internal part, as in metastasis of rheumatism or gout, and retrocession of cutaneous eruptions; the sympathetic extension of irritation; and the morbid influence arising from dependence of function.

5. The agencies which have no necessary relation to the system in health, but yet act upon it injuriously, are beyond all power of enumeration. They may be divided into 1. *mechanical causes*, as all wounding, bruising, or compressing bodies, and all which operate merely by excluding necessary vital agents, as by strangling, suffocating, &c.; 2. *chemical causes*, which act by decomposing the living tissues; and 3. *vital* or *physiological causes*, which act through the peculiar susceptibilities of the system, and their relation to these susceptibilities. In the last class must be ranked all stimulants not essential to health, such as alcoholic liquors, condiments, coffee, tea, &c., which, though they may often be used in moderation without obvious mischief, are the sources of incalculable evil by their abuse; and all the non-chemical poisons, whether solid, liquid, or aëriform. Of the latter subdivisions, some act apparently merely by stimulant or sedative properties, as opium, belladonna, digitalis, tobacco, hydrocyanic acid, sulphuretted hydrogen, &c.; others produce peculiar and characteristic effects, as mercury, lead, arsenic, miasmata, and the different contagions. They may sometimes, possibly, act by mere contact with susceptible surfaces; but, much more generally, they are absorbed into the circulation, and carried with the blood throughout the system. There is no exposed surface of the body through which they may not find access; but the entrance through the cutaneous surface is most difficult, through that of the pulmonary air-cells probably most easy, and through the alimentary mucous membrane of intermediate facility. Under the same general head, may be conjecturally ranked epidemic influences, though these are truly *occult* causes, wholly unintelligible in the present state of our knowledge.

Not unfrequently there is, for a particular disease, a chain of causes, running upwards, through a greater or less number of links, to the first, from which they all depend. Thus, apoplexy may sometimes be traced backwards, through hypertrophy of the left ventricle of the heart, obstruction or deficiency of the cardiac valves, endocarditis, and external rheumatism, to cold; diarrhœa, through irritation of the intestinal mucous membrane, disordered biliary secretion, and hepatic congestion, to miasmatic influence; and dropsy, through general venous congestion, dilatation of the right ventricle of the heart, pulmonary obstruction, and chronic bronchitis, to the habitual inhalation of irritant powders.

It very often happens that numerous causes act on the system at the same time, and occasionally in a similar manner. When these are such as to affect simultaneously great numbers of persons, the most devastating effects are experienced. Thus, a dense population is sometimes exposed to the prostrating influence of meagre and unwholesome diet, impure air, contagious effluvia, and the depressing emotions, and are consequently swept off in vast numbers by typhus fever.

In relation to the character and mode of action of the different causes of disease, and the various circumstances of their application, it would be entirely out of place to treat fully in a general essay. On these points, reference must be had to the accounts of the diseases which they severally produce. Much has been already said, under the head of the constituent forms of disease; and, when there is anything peculiar or specific in the cause of any particular complaint, it will be treated of in the department of special pathology. But there are various morbific agencies, which have so diversified an operation, or involve so much of disquisition in relation to their origin and nature, that there is no one disease under which they can be appropriately considered. These it will be most convenient to treat of in the present place. They may be ranked under the several heads of heat, cold, water in the liquid and aëriform states, electricity, light, atmospheric impurities, miasmata, epidemic influence, and contagion.

Heat.

Heat, in a certain degree, is essential to the healthy performance of all the functions. In excess, it becomes morbidly stimulant, increasing the frequency and force of the pulse, and either augmenting the organic actions, or disturbing them by over-excitement. By its general influence, it is capable of producing a febrile condition, and locally stimulates into inflammation. Beyond a certain degree, it loses its vital in its chemical agency, and produces the death of the part upon which it acts by coagulating the albumen, and causing decomposition through a new play of affinities. It appears to stimulate certain organs more than others, and especially the skin, liver, and alimentary mucous membrane. Irritation and inflammation of these structures are sometimes the direct result of heat. Nature, however, has provided the means of relief, to a considerable extent, by the increase of secretion. Heat is peculiarly apt to induce profuse perspiration, which not only unloads the vessels of the skin, but, by the vaporization of the extravasated liquid, occasions an absolute reduction of temperature in the immediate vicinity, and thus protects the system at large. The liver also is frequently relieved by an increased secretion of bile, and the bowels by a more active exhalation from their lining membrane. Hence bilious cholera and diarrhœa, which often probably prevent attacks of hepatitis, gastritis, or enteritis. Occasionally, heat also acts with great energy upon the brain, but rather in consequence of a direct application, than through any especial affinity for the organ. Serious and even fatal cerebral irritation and congestion sometimes result from the immediate influence of the sun's rays upon the head, when insufficiently protected; and cooks are subject to all the consequences of general vascular fulness of the head, from the necessary exposure of that part of the body to the fire. Along with the effects mentioned, certain other functions are somewhat differently affected. The kidneys not only do not directly feel the stimulus, but generally secrete much less than in health. The urine, however, is apt to be loaded with saline matters, and may become a source of irritation by this concentration, or by deposition in the passages. Urinary diseases have been noticed among the morbid effects of sleeping too warmly in feather beds. The circumstance that less evolution of heat is required in the system, when already overheated, renders the oxidation of carbon less necessary, and consequently tends to reduce the activity of the pulmonary function. The lungs, therefore, are less excited than other organs, and hence their comparative freedom from disease in hot countries. Though the sensations and emotions, which may be deemed passive functions of the nervous system, do not seem to be impaired or diminished by a moderate excess of temperature, the more active functions, as those of muscular motion, and of intellect, are depressed; as evinced by the general languor, and indisposition to exertion, whether of body or mind. The latter effects are ascribable to that conservative or compensating principle of the system, which provides that those actions of an already excited part which would tend to increase the excitement, should be rather checked than augmented; as a muscle, for example, refuses to contract when affected by rheumatic irritation.

In consequence of the refrigerating effects of profuse perspiration, a very high degree of temperature may be borne for a considerable time. Numerous instances are on record, in which individuals have remained for several minutes, with perfect impunity, in ovens or apartments heated over the temperature of boiling water. The experiments of Dr. Fordyce and Dr. Blagden are well known, in which they bore, for a considerable time, and without much inconvenience, a temperature of 260° F.; while eggs were roasted hard, and beefsteaks cooked, by the mere heat of the air about them. Their pulse was much excited, but the interior temperature was not increased, nor was the breathing materially affected. It is said that the famous Chabert was in the habit of entering an oven, the temperature of which was between 400° and 600°. (*Carpenter's Princip. of Hum. Physiol.*) The non-conducting property of dry air has, undoubtedly, much to do with the impunity in such experiments.

There are other secondary effects of heat which merit notice. The organs, excited to unusual secretory efforts, become afterwards relaxed, and are, in this state, peculiarly liable to suffer from the influence of miasmata and cold. Moreover, repeated excitation at length wears out the excitability of the organs, which consequently become, in some degree, insensible to the ordinary healthy excitants, and perform their proper duties less efficiently; while, from the constantly renewed irritation, they are apt to fall into a condition of chronic inflammation. Hence arise dyspepsia, portal congestion, constipation, chronic hepatic and gastro-intestinal inflammations, and various cutaneous eruptions.

Heat is morbidly applied in various ways. Its local effects of burning and scalding are produced by the direct application of flame, or of heated solids or liquids, to the surface; and sometimes, it is received into the trachea, in the form of flame, with fatal results. Its general effects are produced through the medium of the atmospheric air in summer, or by confinement to heated rooms in winter, or by too much clothing, or sleeping too warmly, at all seasons. The effect of heat is much increased, when connected with water. Hence, the abuse of hot baths, and vapour-baths, may lead to disease. It may also act by means of hot liquids swallowed.

Cold.

In relation to the principles upon which cold acts, something has been already said under the head of *depression*, to which the reader is referred. In this place, it is proposed to give a more comprehensive view of its effects as a morbific agent. On the occasion alluded to, cold was shown to be necessarily sedative or depressing. Under the local influence of cold, the tissues shrink, the capillaries circulate the blood less vigorously, secretion is checked, sensibility is impaired, and the part becomes pale from the want of blood, or purplish from its stagnation. Should the application continue with intensity, a deadly whiteness ensues, circulation ceases entirely, sensibility is lost, and, though vital power is not immediately destroyed with the loss of action, local death soon follows, unless the cause be removed. When the influence is general, the whole surface undergoes the change above described; while the interior functions exhibit a similar depression. The heart acts by degrees more and more feebly, a general torpor steals over the senses, the movements become tottering from muscular weakness, and the benumbing influence extends at last to the brain, giving rise to wandering of the thoughts, drowsiness, and finally an irresistible propensity to sleep. Death speedily follows, and the body is surrendered to physical laws.

But there are other, and very important effects of cold, which must not be left out of view. In the midst of its depressing action, as above described, it produces a peculiar sensation, which we denominate the feeling of cold, and which is agreeable, or, otherwise, according to its degree, and the previous state of the surface. When the application is made suddenly, and with considerable intensity, this sensation amounts to a shock upon the nervous system, which rouses up the energies of the interior, and leads to important results. Should the agency continue undiminished, this feeling of coldness is succeeded by positive pain, often very distressing, which is either local or more or less general, according to the extent to which the cause is applied. There is often also greatly increased sensitiveness to painful impressions, so that a slight blow upon the part occasions acute suffering; and all this takes place, while the circulatory actions, special sensibility, and nervous energy, are greatly impaired, as shown by the shrinking, pallor, numbness, and diminished power of motion. This peculiar, painful impression upon the nerves, in the midst of an otherwise universal depression, was no doubt intended to rouse the attention of the individual to his condition, so that he might seek timely means of relief; while the sympathetic connexion of the sentient surfaces with the interior sources of vital action is such, that the powers of the system are also called forth, through its instrumentality, to obviate the evil as far as possible. With the continued action of the cause, however, this influence ceases, and the cold is completely triumphant.

Consequent upon the strong impression just alluded to is organic reaction, which may be entirely local when the cold is applied to a limited space, but is general when the cause is general, or extensive in its operation. (See *Depression.*) This reaction is often healthful, and the cold then proves indirectly invigorating; but it may also be carried so far as to become morbid. In the latter case, we have, from the local reaction, redness, swelling, and pain in the part impressed, amounting frequently to inflammation; and from the general reaction, accelerated circulation, increased heat, disordered digestion, &c., amounting often to fever. Now, it is not only the part to which the cold is directly applied that undergoes depression, and subsequent reaction; but various other parts, also, which are connected sympathetically with the first. Thus, cold to the outer surface affects, in a similar manner, the skin, which receives the impression, and the interior mucous surfaces to which it is conveyed by sympathy, or, to speak more precisely, to which it is transmitted from the nervous centres that receive it from the skin. The morbid effects are, indeed, more frequently developed internally than externally. In order that the effects of reaction after cold may be experienced, there must be a certain degree of energy in the system, and the agent must not be too intensely, or too continuously applied. In a system previously exhausted, reaction may never take place; and, when the cold is intense, the efforts at reaction are in a greater or less degree repressed, and, if the cold continue, give way at length altogether.

Another method in which cold may become a source of disease, is by the concentration of blood and of nervous energy in the interior organs, consequent upon their retrocession from the skin, and the parts which sympathize with the skin. It is obvious that the quantity of blood is diminished in the superficial vessels. It must necessarily, therefore, be increased in those within. It is equally certain that nervous action is depressed upon the surface; and it is highly probable that this also is concentrated in the interior organs. Excess of blood, and excess of nervous energy combined, cannot but frequently eventuate in disease.

Still another, and probably one of the most important morbid effects of cold, is the suppression of perspiration, resulting from its sedative influence upon the superficial capillaries. Perspiration is usually the result of some general excitement, as from exercise, heat, &c., which finds a safe issue by the skin. If this be closed, the excitation is necessarily directed to some one of the interior organs, and proves the cause of inflammation. Very probably, also, the suppression may sometimes be injurious by preventing the escape of noxious matter from the blood.

The power of resisting the injurious effects of cold is in proportion to the vital energies of the system, and to the grade of its actions at the time. A vigorous person resists it better than one who is feeble; and a high degree of excitement often prevents its evil consequences. In the debility of convalescence, or in the exhaustion and relaxation which follow excessive actions, cold readily occasions morbid results. They who live on animal food can bear it better than others whose diet is exclusively vegetable. In febrile disease, with the pulse frequent and the skin hot, it acts often most happily in allaying excitement, and, instead of proving a morbid agent, is remedial. Every one knows that cold is especially injurious when the skin is perspiring and relaxed, after exercise in hot weather. But, if applied during the continuance of the exercise, the stimulus which this affords counteracts its sedative influence, and very often no evil results. Thus, when the skin is heated by a hot bath, or vapour-bath, so as to be decidedly above the healthy standard, even though perspiring, cold is generally innoxious; while it is much otherwise after immersion in a merely tepid bath, which relaxes instead of exciting the surface. Persons coming out of a hot bath sometimes plunge into the snow with perfect impunity; but the act would be very hazardous for one just out of a merely warm bath. Even mental preoccupation is preservative, in a considerable degree, against the morbid effects of cold. In its sympathetic operation, and, to a considerable degree, in its immediate operation, this agent acts through the nervous system; and, if that system is under powerful impressions of other kinds, it is less sensible to that of cold. Hence, maniacs often bear a degree of exposure which would prove highly dangerous to the same persons in health. We seldom hear of any injury from the immersion of the body in baptism, even during the coldest weather. Habit also has great influence in obviating the morbid effects of this agent. They who are accustomed to cold will bear a degree of it under which others would sink. Sleep usually favours the morbid action of cold by the relaxation of surface, and general diminution of action which attend it. Persons very frequently take cold by exposure to the cause during sleep.

From what has been said, it may be inferred that vicissitudes of cold and heat are more injurious than a steady prevalence of cold alone, unless in great excess. A tendency to moderate and healthful reaction is produced in the latter case, and sustained by the fresh support which the system constantly receives, through the invigorated appetite and digestion. In the former case, he stimulant effects of heat are sometimes superadded to the reaction of cold before this has subsided, and thus render morbid what might otherwise have remained within the limits of health. The cold, too, operating during the relaxation which follows heat, has a much greater effect than if there had been no such contrast.

The effects of cold are much increased by currents of air. The atmosphere is a slow conductor, and the body cools very slowly when surrounded by the air at rest. But, when it is in motion, a fresh portion constantly takes the place of that which had been warmed by the surface, and thus greatly increases the rapidity with which the heat is abstracted. It is a common observation, that *draughts* of cold air are highly injurious. So also is the partial application of cold, especially to portions of the body unaccustomed to it. Many persons will begin to sneeze, or be sensible of a sore-throat almost immediately, if exposed to a current of cold air upon the back of their neck. The effects of cold air are much increased by its association with moisture, in consequence of the much greater conducting power of the latter.

It is believed that, in the above sketch of the operation of cold, the reader will find principles which will explain at least most of its effects in the production of disease. By its direct, local, depressing agency, it sometimes, when intense, destroys the life of the part, and, in a less degree, may produce fatal prostration, when the organ upon which it acts has a wide circle of affinities. Such has often been the result of drinking freely of very cold water, when the body was hot and perspiring. Instances are not uncommon of persons being frozen to death, by exposure to the general influence of cold. The fact is, that the body is not really frozen, at least beyond the surface, before death. The fatal result is ascribable simply to the depressing influence of the cold. Such instances are most common among the intemperate, whose vital resistance is less than in health, and who are too often insensible to the danger, and therefore can take no means to obviate it. The long continued influence of a more moderate degree of cold is apt to wear out the powers of reaction, especially when aided by want of food, and other sedative agencies. A state of system is thus produced, highly favourable to typhous and scorbutic diseases; and, when the individual may be attacked with another disease, even though inflammatory, it is apt to assume a low, asthenic, or typhoid character. I believe, also, that a strong predisposition may thus be developed to phthisis or scrofula, or an existing predisposition to these affections called into action.

By the reaction which generally follows cold, it often gives rise to that troublesome affection commonly called chill-blain or frost-bite, and may generate various other forms of cutaneous inflammation. There is reason to believe that many cases of internal mucous inflammations arise in the same way. The admission of very cold air into the bronchial tubes is probably sometimes followed, upon subsequent exposure to heat, by a reaction amounting to bronchitis. The same membrane, as well as that of the alimentary canal, may be affected in like manner by its sympathies with the skin.

But, probably, a more frequent source of internal diseases from cold is the irregular direction given to the blood, and the nervous influence, by the depressed state of the surface, and the suppression of the perspiration. There is scarcely any form of internal inflammation, not of a specific character, which may not have its origin in this cause. The same may be said of irritations of all grades, with congestion, increased secretion, or hemorrhage. Even specific diseases, which require a peculiar diathesis for their production, are often brought into positive existence through this action of cold. Illustrative examples of this principle of action we have in the phlegmasiæ of the brain, and of the thoracic and abdominal viscera, the active hemorrhages, diarrhœa, cholera, dropsy, rheumatism, and gout.

Cold, as a morbific agent, most frequently affects us through the atmosphere. It often also operates through the instrumentality of water applied to the surface, as in the case of wet feet, and wet or damp clothing. Sometimes, though very rarely in comparison, its primary action is internal, as in the case already mentioned of cold water taken into the stomach, when the body is perspiring from heat and previous exertion.

Water.

The influence of water upon the system, when in excess, is decidedly sedative; and it differs in this respect from cold, that its depressing effects have no apparent tendency to produce reaction. Operating probably by penetrating the tissues, it appears to increase the distance between the living molecules, to diminish their vital cohesion, and thus not only to lessen the action of the part, but also to impair its powers. This result happens, no matter to what surface the water is applied, or by what avenue it enters the system, provided only that it be in excess. Hence the relaxing effects of damp warm weather, of the tepid bath, of emollient poultices, and of warm water taken into the stomach. It will be readily inferred that a frequent or habitual exposure to this cause of depression must eventuate in diseases of debility, or at least must strongly predispose to them. The system is placed by it in a condition peculiarly favourable to the influence of cold, and is, therefore, rendered liable to inflammations; but the inflammatory affection partakes of the pervading character of debility, and is apt to assume a low, sub-acute, or scrofulous, and sometimes very obstinate form. Taken copiously into the stomach, it impairs the energy of that organ, while it interferes with the process of digestion by too largely diluting the food. The habit, therefore, of drinking copiously even of water may induce dyspepsia.

There is one effect of water apparently stimulating; an increase, namely, of the secretions, more especially of the urine and perspiration. When taken into the stomach, it is rapidly absorbed, and conveyed into the circulation, where, if in excess, it distends the vessels, and, by this distension, affords the stimulus necessary to secretion. It is, however, mechanically, and not by any inherent stimulating power, that it produces this effect.

But water is seldom so employed or applied as to produce its own peculiar effects without modification. The condition by which its action is most frequently modified is temperature. It much oftener acts as the mere vehicle of heat, or of cold, than by its own peculiar powers. In order that the effects of water alone may be experienced, it must be applied so as to produce the impression neither of heat nor of coldness; in other words, it must be as nearly as possible of the temperature of the body externally, that is, tepid or lukewarm. It is very important to bear this fact in mind in practice.

When the vehicle of heat, water becomes stimulant, whether used externally or internally. It is true that its own peculiar influence must be exerted; but this is greatly overbalanced by the much more powerful influence of the heat, when the latter is at all considerable. There is, however, a point at which the two very nearly balance each other; and, if the object be to use the water merely for purposes of cleanliness, without a view to any impression whatever on the system, such a mean should be aimed at. The stimulant influence of the hot bath is exhibited in the universal redness of the skin, a feeling of agreeable cerebral excitement, and an accelerated pulse. Hot water in the stomach excites that organ to increased activity, and adds much to the effect of the tea, coffee, &c., with which it is usually administered. In both cases, it may become a source of disease, either by over-stimulation, or by impairing the excitability of the system, or of the parts more especially excited. There can be no doubt that the free use of hot drinks contributes to the production of dyspepsia. But there is another effect of heat and water combined which merits notice. It has before been stated that water taken freely into the stomach promotes secretion. Hot water promotes especially the perspiratory function. This it does, probably, in consequence of an impression of morbid heat, transmitted to the sensorium from the stomach, and other parts of the body, and reflected from the nervous centre to the skin. The end obtained, through this sympathetic influence, is the elimination of the excessive heat, which is carried off by the evaporation of the moisture at the surface. Were the action to be directed to the kidneys, no effect of this kind would be produced. This excess of perspiration may sometimes be a cause of disease, though practically it is much more frequently a remedy.

Water, associated with cold, greatly increases the effect of that agent, partly by superadding its own sedative influence, but probably in chief by its conducting power, which so much exceeds that of air. Hence, a cold damp atmosphere is much colder to the senses than a dry one at the same temperature, and is, in the same degree, more apt to produce all the morbid effects of cold. The same may be said of wet clothing, compared with dry. Cool water, as a bath, is less relaxing than warm water, because it excites to reaction; but, after a certain time, this reaction ceases, and then the sedative effect both of the water and the cold is experienced. Hence, in bathing, even though the temperature may not be very low, the vital actions often become much enfeebled, and the individual is ultimately exhausted. In very cold water the effect is much more speedy. As hot water gives a direction of secretory action to the skin, so does cold to the kidneys. Externally applied, the latter checks perspiration, and thus throws the onus of unloading the bloodvessels upon the urinary organs. But, whether externally, or internally used, it probably operates on the kidneys by the same nervous instrumentality as that which directs the action of hot water to the skin; the end, in this instance, probably being, that the ordinary refrigerating process going on at the surface in health might be diminished, so as to husband the heat; while, in order to prevent excess of liquid in the circulation, the kidneys are stimulated into extraordinary action.

A morbid influence of moisture not yet mentioned deserves a brief notice. Through its affinity for miasmata, it is apt to become impregnated with that poison, and in the form of fogs, or mere aërial dampness, may produce serious effects on those who breath it.

A certain amount of water in the air is not less essential to life than water in the form of drink. A perfectly dry air is highly dangerous, in consequence of absorbing all the liquids of the body to which it can have access. The fatal winds of the African desert are said to owe their deleterious influence to this cause. The skin becomes arid, the mouth and fauces parched, and the bronchial tubes themselves dried up, so that the patient is unable to breathe, and speedily perishes.

Light.

Though so important to our comfort, and all our higher interests in this world, light does not appear to be a very powerful pathological agent. It has little observable influence over any of the functions or organs, except the one specially formed for the reception of its impressions. Upon the eye it acts as a stimulus, capable, when in great excess, of completely paralyzing the sense of vision, by exhausting the excitability of the retina, and, more moderately applied, of producing various degrees of irritation and inflammation in the organ. Its influence may even extend through the eye into the sensorium, and injuriously excite the brain.

It is highly probable that light influences our organic functions, in a manner analogous to that of its action upon plants, which are well known to lose their colour, and to have but a feeble growth in the dark. Accordingly, it is observed that persons, long excluded from the light, become very pale, and of a lax and feeble habit of body, which disposes them strongly to scrofula and phthisis, and favours the production of scorbutic and dropsical affections. But, as persons thus excluded are usually shut out from other sources of health, as, for example, from exercise, fresh air, and cheerfulness of spirit, it is impossible to determine how much of the result is ascribable to the want of light, and how much to other causes.

Electricity.

The wide diffusion of this principle, the almost universality of its interference in the physical processes which are going on around us, and the peculiarity of the effects which it is known to produce upon the system, justify the conjecture that it is also a powerful agent in the generation of disease. When its nature and laws, and its relations to the system come to be better understood, it is highly probable that we shall find it to be one at least of those mysterious influences which so often disturb the vital processes, and spread havoc among organized beings, without our being able to discover whence they come, or whither they go, or where they dwell when apparently amongst us. The sense of oppression, languor, and general uneasiness, so often experienced before a thunder storm, and so completely dissipated with the occasion which produced it, is among the proofs of a constant operation of atmospheric electricity upon our systems, and of the dependence of our health upon a proper equilibrium of that principle. It must be confessed, however, that our knowledge of the pathological agency of electricity is exceedingly limited. It does, indeed, appear to be confined to the fact, that it is a powerful stimulant to the nervous system, capable of increasing its action, in various degrees, and even of completely exhausting and prostrating it by one powerful shock, so as to produce local or universal palsy, and consequently immediate death. This effect of electricity is experienced, as a natural result, only from lightning, which acts also, when the living body becomes a recipient of its current, in the same destructive manner as upon inorganic bodies; namely, by a mechanical rupture of parts, and by the destructive evolution of caloric.

Atmospheric Impurity.

This is an abundant source of disease. But it is singular, how few of the numerous exhalations which render the air impure are definitely known. Carbonic acid, carbonic oxide, the different forms of carburetted hydrogen, hydrosulphuric acid, and sulphurous acid, are almost all that proceed from natural sources, or ordinary artificial processes, in quantities likely to prove injurious to health. Others, such as chlorine, muriatic acid gas, nitric oxide or nitrous acid vapour, and ammonia, are occasionally evolved in the laboratory, or for purposes of fumigation, and prove the source of injury in some rare cases. But, besides these, numerous aeriform products, not well ascertained, are constantly evolved by vegetable and animal exhalation, by spontaneous decomposition of organic or mineral substances, by combustion, by manufacturing operations, and by evaporation of every liquid on the face of the earth, which tend to contaminate the air, and render it more or less noxious to animal life.

The morbid effects of all these aeriform products may be embraced under the following heads. In the *first* place, when sufficiently concentrated, they may destroy life by excluding atmospheric air from the lungs, and thus producing asphyxia. This they may do, either by entering the lungs, and thus taking the place of pure air, or, in consequence of their irritant properties, by causing spasm of the glottis. *Secondly*, they may be simply irritant, and act by producing inflammation of the air passages. *Thirdly*, they may be absorbed both through the lungs, and through other avenues, as the skin, and the mucous membrane of the stomach which they may reach along with the saliva; and, thus entering into the circulation, may exercise a poisonous influence upon the whole or any part of the system. A few remarks in relation to the several gases, the operation of which has been observed, will not be irrelevant.*

Carbonic acid is poisonous only when in a certain degree of concentration. In a very dilute state, it is always present in the lungs. When pure, it probably causes a spasmodic closure of the glottis, and thus produces complete asphyxia. When so much diluted as to be allowed an entrance into the bronchia, it acts either by preventing the escape of carbonic acid from the blood, or by being absorbed into the blood. In either case, the result is the same; that is, an undue accumulation of carbonic acid in the circulating fluid, and a consequent narcotic action upon the brain; while the respiratory process ceases, from the want of action in the pulmonary capillaries. The symptoms, therefore, are those of asphyxia and cerebral oppression combined. (See *Asphyxia.*)

In the quantities necessary for the production of the effects just mentioned, carbonic acid may be generated by combustion, respiration, fermentation, the preparation of lime, and various chemical processes which are going on in nature. The most frequent source of danger is probably the burning of charcoal or anthracite in close apartments. Partial, and, in some few instances, fatal effects, have resulted from the confinement of many persons in a small apartment, without ventilation. Brewers' vats have sometimes proved fatal to the workmen who have entered them. We now and then hear of deaths occasioned by persons sleeping, in cold weather, for the sake of the warmth, in the vicinity of lime-kilns. It is often owing to the accumulation of carbonic acid, that death has resulted from the descent into old mines, pits, caves, &c. The weight of the gas causes it to maintain, for a time, its position in these depths, when generated there.

Carbonic oxide appears, from the experiments of Mr. Higgins, of Dublin, to be powerfully narcotic, producing quickly, when inhaled in a pure state, a loss of sense and motion, followed, if the patient revive, by headache, drowsiness or stupor, giddiness, blindness, nausea, and a quick irregular pulse; and the same symptoms, in a milder degree, are produced by the inhalation of the diluted gas. It is said that this gas is evolved along with carbonic acid from the slow combustion of charcoal; and we may thus, perhaps, account for the asserted fact, that the gaseous products of burning charcoal are more dangerous than pure carbonic acid.

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* It has been rendered probable by Schönbein, that the peculiar atmospheric ingredient or condition which he names *Ozone*, has the property of decomposing most of the deleterious effluvia which are constantly escaping into the air by deoxidizing them, and that the preservation of the purity of the atmosphere is the important function, in the economy of nature, for which this extraordinary agent was destined.—*Note to the fourth edition.*

Carburetted hydrogen can scarcely be very noxious, at least the form of it denominated light carburetted hydrogen, or fire-damp; as it is constantly inhaled by miners with impunity, even in mixtures which are highly explosive, when entered with an unprotected lamp. In a certain degree of concentration, however, it is capable of producing fatal effects; and symptoms of narcotic action, with great depression, have been observed before death, and in cases of recovery. But it is doubtful whether the apparent narcotism is anything more than the result of the venous congestion in the brain, consequent upon the suspension of the respiratory process.

Hydrosulphuric acid, or *sulphuretted hydrogen*, is undoubtedly a most violent poison. It is capable of destroying life, no matter by what avenue it may enter the system, whether by the lungs, the stomach, the rectum, or the skin. According to Chaussier, a horse was killed by breathing atmospheric air containing a 290th part of this gas. Nine quarts of it, injected into the bowels of a horse, killed the animal in a minute; and a rabbit, whose body was surrounded with the gas, so as to affect only the skin, died in ten minutes. (*Christison on Poisons.*) Symptoms of great nervous derangement, with immense prostration, result from its action. In minute quantities, it occasions nausea, drowsiness, and nervous pains; in larger quantities, either stupor or convulsions, with a cold skin, and feeble irregular pulse, followed often by total insensibility and death; in a concentrated state, sudden prostration and fatal asphyxia. It appears, therefore, to be a powerful sedative agent, acting especially upon the brain and nervous system. There is good reason to believe that it is capable, when inhaled with the atmospheric air, in very small proportion, of inducing a typhoid state of fever, or at least of strongly predisposing to that condition, when fever may be excited by any other cause. Its most frequent source is in privies, whence it is exhaled with ammonia or its compounds, and possibly other noxious gases.

Of *sulphurous acid*, as a morbific agent, little more is known than that it is a powerful irritant. So powerful, indeed, is it in this respect, that it could scarcely enter the lungs in any considerable degree of concentration. It is produced, along with carbonic acid, in the combustion of anthracite coal, and adds greatly to the deleterious properties of the latter gas.

Of *chlorine*, *muriatic acid gas*, *nitrous acid vapours*, and *ammonia*, it is unnecessary to say more than that they are violently irritant, and produce, in a certain state of concentration, speedy and severe inflammation of the air-passages, so far as they can penetrate.

The unknown vapours, or gaseous bodies, which deleteriously impregnate the atmosphere, require only a brief notice. They are generally most abundant where men are most collected together, and where, consequently, most abound the aëriform emanations from animal excretions, magazines of all sorts of provision, the combustion of wood and coal, cooking in all its forms, and every variety of chemical process which the wants of a large population require. Hence, the air of large cities is apt to be impure, and to a certain degree unhealthy. The effects of the air must be so varied from its varied composition, as to defy analysis. But, generally, the energies of the system appear to be diminished, and the vital processes are carried on more feebly than in a pure air. This is often strikingly seen in the invigorating influence exerted by the air of the country upon invalids from cities. It is probably rather as a predisposing than as an exciting cause of disease, that this impure air acts. Its influence is visible in the typhoid tendency often given to the fevers during winter, and in the extreme fatality of the infantile cholera of cities, during the heat of summer. Infants suffer more from this cause than adults, whose systems have become habituated to it; and young men from the country often undergo an acclimating attack of disease, before they become completely naturalized.

Animal effluvia.—Under this head may, without any great violence, be arranged the effluvia which result from the decomposition of the exhalations and excretions of individuals of filthy habits, or crowded together in confined apartments. Allusion is not had to those morbid emanations, which are the immediate result of a secretory process, and which have the power of generating the same disease in others as that by which they were themselves produced. Such effluvia belong to the category of contagions, and will be considered under that head. The morbific emanations to which reference is now made, are the result of decomposition, which may have originated within the body, as in the case of the feces, but more frequently does not commence until the secreted or excreted matter has been eliminated, as in the case of the urine, perspiration, saliva, and breath. Where due attention is paid to cleanliness and ventilation, such decomposition is productive of no evil; for experience has abundantly shown, that the resulting products are only injurious when in a certain degree of concentration. Even when most copiously evolved, and under [illegible] circumstances, they are quickly diluted beyond [illegible] point by the contiguity of the open air; and their evil effects, therefore, are seldom or never experienced beyond a few feet from their place of origin. There is reason, indeed, to believe that they adhere, to a certain extent, to the clothing and persons of individuals, and may thus be conveyed to a distance from their source; but it is very possible that, in such cases, it is less the effluvia themselves that are conveyed, than the materials out of which they are formed, which remain in the clothing or attached to the surface of the body.

The nature of these effluvia is unknown. It is highly probable that sulphuretted hydrogen is one of their ingredients. They generally have a disagreeable odour, which often strongly recalls that of malignant typhus. They are generated usually in the hovels and cellars of the poor, in which many persons often dwell in the same small room, and where no attention is paid to personal cleanliness, or to proper ventilation. But they may be developed in any situation in which numbers are crowded together, as in prisons, infirmaries, besieged fortresses, camps, and ships, when due regard to the health and comfort of the inmates is neglected. The winter season is peculiarly favourable to their influence, because economy in relation to fuel induces the inmates to close every access to the external air; so that the warmth necessary for the decomposition is produced, and the resulting effluvia are accumulated in the greatest possible degree. They are sedative or depressing in their action, and, while they lower the energies of the nervous system, probably tend also to corrupt the blood. Hence, they impress on all the diseases which result from other causes a low or typhoid character, and when sufficiently concentrated, are not unfrequently of themselves competent to the production of typhus fever. Among the effluvia just alluded to, are not included those which result from the putrefaction of the dead bodies of animals, or portions of them. Experience has shown that these are not apt to produce disease, in any degree of concentration in which they are at all tolerable to the sense of smell. Hence, butchers, skin dressers, glue manufacturers, &c., who are much exposed to these offensive effluvia, are not peculiarly liable to disease.

There are certain aërial depravations, the nature of which is not exactly known, but which, from their great importance as causes of disease, require a distinct notice. Such are the emanations usually denominated miasmata, or malaria, and those distemperatures of the atmosphere which occasion epidemics. These I shall proceed to consider.

Miasmata.—Malaria.—Marsh-miasmata.

It has been observed that, in certain regions of country where abundant vegetable decomposition accompanies an occasional overflow of the soil, and at the season when this decomposition is most rife, a certain class of diseases is apt to prevail, entirely distinct from those which arise from irregularities, or changes in the sensible qualities of the atmosphere. This result has been usually ascribed to aëriform exhalations, which have received the name of marsh-miasmata, or malaria, the former intended to express their origin and nature, the latter simply the fact that they render the air unwholesome. It was proposed by the late Dr. Edward Miller, of New York, to distinguish these effluvia from such as have their source in personal uncleanliness, [illegible] giving to the former the title of *koino-miasmata*, and to the latter that of *idio-miasmata*, the first implying a common or general, the second a private or peculiar origin. This nomenclature has been adopted by some practical writers; but there is no such relation between the two morbid causes as to render their association in one category desirable; and, in this work, the term *miasmata* is restricted exclusively to the paludal exhalations, while those from the person are noticed simply as one of the forms of atmospheric impurity. (See *Animal effluvia*, page 152.)

The circumstances which appear to be essential to the production of miasmata are heat, moisture, and vegetable decomposition. The peculiar morbid effects ascribed to this cause, and by which alone its existence can be recognized, seldom originate at a temperature under 60° F., even though vegetable decomposition may be going on. At 80° they are often very prevalent, and are generally checked by the occurrence of frost. A certain continuance of the heat is not less necessary than a certain degree of it. Hence, miasmatic diseases seldom prevail beyond the 56th degree of latitude; because, though many days in summer may be very hot, the warm season is short. The nearer we approach to the equator, the more violent, as a general rule, do they become, implying a greater intensity of the cause. Within the latitudes where there is a regular change of the seasons, they do not commonly make their appearance until the middle, and often not till the close of summer.

Moisture is necessary to the evolution of miasmata, but much of it often serves as a preventive. During heavy rains, for example, their morbid effects are less felt than after the rains have ceased, and the water has run off from the surface of the country, or been partially evaporated. In tropical latitudes, it is after the cessation of the rains, that the ravages of the malarious fevers commence. Surfaces, deeply covered with water, evolve less of the noxious effluvia than those which are but partially covered. It has been observed that, in very wet seasons, the lower grounds, usually most unhealthy, are least affected; while the higher, which are ordinarily exempt from disease, become sickly.

Vegetable decomposition has been mentioned among the requisites. That it is so, is inferred from numerous circumstances attendant upon the developement of the morbific influence. In no situations is this so powerful as in the deltas, and along the banks of large tropical streams, which, in their period of flood, bring down the washings of the soil loaded with vegetable remains, and, upon subsiding, leave them reeking in the hot sun. It is also peculiarly destructive when grounds covered with a luxuriant vegetation are overflowed, so as to destroy the plants, and occasion their putrefaction. Hence, miasmatic diseases are apt to follow the submerging of meadows in order to increase their fertility, the forming of mill-ponds, and the damming of streams for the purposes of navigation. Neighbourhoods, before remarkably exempt from disease, have thus become very unhealthy, and have not ceased to be so until the vegetable matter, thus deprived of its life, has undergone complete decomposition. The draining of lakes, ponds, &c., is often followed by disease; because the organic matters, previously lying quiescent in their beds, are brought into a renewed movement of chemical reaction by exposure to the sun's heat. Hence, too, the increase of disease which often follows the commencement of cultivation, in a newly settled country, in consequence of the turning up of the soil, loaded with vegetable remains. The digging of canals has often been noticed to produce similar effects, and probably from the same cause. The prevalence of miasmatic fevers in the latter part of summer, and in autumn, may be ascribed in part to the circumstance, that vegetable life has now very frequently run its course, and plants are consequently exposed to decay. A long continuance of dry weather, followed by warm rains, favours the evolution of miasmata, probably because the plants, which perish in the drought, suffer speedy decomposition under the conjoined influence of the heat and moisture.

It is a happy circumstance, that, though the first steps of civilization in a wild malarious region, often rather increase the production of the poisonous agent, yet, with the progress of cultivation, the country becomes more healthy even than it was originally, in consequence partly of draining and embankments, and partly, perhaps, of the productive growth to which the vegetable decay is made tributary. The rotting of hemp in still water, and the spontaneous decomposition of the indigo-plant, in the preparation of that dye-stuff, are asserted to give rise to miasmatic fevers.

One of the most interesting circumstances in relation to miasmata is their apparent affinity for moisture. Water appears to have the property of dissolving and retaining them, whether in a proper liquid state, or in that semi-liquid form in which it constitutes fogs and mists. Numerous facts may be explained upon this principle. It is probably owing to this cause, that heavy and continued rains lessen the miasmatic influence. They wash the atmosphere clean of the noxious effluvia. Hence, too, the protective influence of floods and of deep water, which dissolve the miasm as it is generated, and prevent its escape by retaining it in solution. The greatest danger is after the waters have so far subsided, or been so far evaporated, as to be unable longer to dissolve the proceeds of the vegetable putrefaction. It is said that, in tropical latitudes, the commencement of the rains is rather promotive of disease, partly, perhaps, by bringing down the miasmata from the upper air, partly by favouring the decomposition of the dead plants upon the surface of the earth. Upon the principle of this affinity, may also be explained the influence of running water in obviating the effects of marsh effluvia. Salt marshes are thought to be less unwholesome than fresh; and some suppose that a meeting of salt and fresh water is peculiarly injurious. But it is unnecessary to adduce any especial influence of the salt in these instances. If salt marshes are less malarious than fresh, it is probably owing to the action of the tides, by means of which, in the former, the results of the vegetable decomposition are carried off by the flood; while the waters, in the latter, being more frequently stagnant, become saturated with the poison, and permit it to arise with the exhalation from their surface. At the points where the salt and fresh waters meet, there is often more stagnation than either above or below, because the flux and reflux of the tides are less than in the latter position, and the steady downward current of the former is wanting. Persons on board of ships, and those on the sides of lakes opposite to the source of the exhalation, are much less exposed to disease than those at an equal distance by land, because the intervening water dissolves the miasmata in their passage.

It is probably owing to the affinity between miasmata and moisture, rather than, as some have supposed, to any superior specific gravity of these effluvia over the air, that the greatest danger generally exists near the surface of the earth. Thus, it has been observed that persons in low grounds are more exposed to sickness than those who live in elevated positions; and instances have been recorded, in which lodgers upon the lower floor of a house have been attacked, while those upon the upper have escaped. Fogs, in which the poisonous exhalation is probably dissolved, are well known to affect especially the surface of streams, and the low lands in their neighbourhood; and very often their upper limits are but a few feet above the soil.

For the same reason, the morning and evening air is peculiarly injurious; so much so that persons who go out of their houses only during the day, after the fogs have dispersed in the morning, and before the dews descend in the evening, are apt to escape altogether. I was formerly the attending physician of a public institution, containing more than a hundred inmates, among whom, during the sickly seasons to which our vicinity was subject, autumnal fever was very prevalent, until the direction was given, and carried into effect, not to allow any one to go out before breakfast, or after tea. The miasmatic effluvium appears to rise by the heat of the sun, and to be so dispersed as to become innoxious, but to acquire a dangerous concentration by its union with the moisture which forms the morning and evening dews. Exposure, in the middle of the night, is equally dangerous, and especially during sleep, when the power of resisting noxious agents is diminished. Hence the peculiar danger of sleeping in tents, in sickly regions. The season at which miasmatic fevers commence, is generally that at which the greater coolness of the evening causes the formation of dews. I have been informed by a person conversant with the miasmatic districts of our country, that, in the vicinity of rapids, there is much more danger than along the banks of the streams where they flow calmly. If this be a fact, it admits of the ready explanation, that the water, loaded with the miasmata in solution, does no harm while confined within the banks, but becomes highly noxious, when driven up, in foam and spray, into the atmosphere, so as to be inhaled by the neighbouring residents.

Another important fact is the influence of winds upon miasmatic exhalations. By reference to this, we are enabled to explain many apparent anomalies. It occasionally happens that a low district, where the miasmata are extricated, is less unwholesome than a neighbouring elevation, towards which a prevalent wind blows over the source of production; and, from the same cause, one side of a mountain may be very sickly, while the opposite side is remarkably healthy. The bank of a stream, in the direction of the ordinary winds, is sometimes more sickly than the opposite bank, though the latter may be nearer the spot where the cause originates. Violent storms sometimes prove useful, by dispersing miasmata which may have accumulated in consequence of previous stagnation of the atmosphere. Winds appear to be capable of carrying miasmata, either enveloped in clouds and fogs or otherwise, a very considerable distance; according to McCullough, even so far as five or six miles. In this way, we may sometimes account for the occurrence of disease in spots, which seem to offer none of the circumstances ordinarily considered essential to the production of malaria. Various impediments seem capable of turning off the deleterious current. Thus, hills or mountains protect the regions beyond them, partly in this way, partly, perhaps, by their affinity for fogs and mists. A thick wood will occasionally divert the course of a miasmatic wind; and thus afford protection to a dwelling or even a whole neighbourhood. The late Dr. Joseph Parrish, of Philadelphia, used to speak, in his practical lectures, of a case that fell under his observation, in which a family, previously in good health, was attacked with a violent and fatal fever, apparently in consequence of having cut an avenue, for the sake of a more extensive view, through a wood which intervened between them and a large tract of marsh. Occasionally, a region of country is so formed that a low marshy expanse terminates in a comparatively narrow passage through high grounds, serving as a sort of funnel, in which the miasmata are concentrated by prevalent winds. In such instances, the sides of the passage referred to are apt to be very sickly. It is obvious that a low miasmatic source, surrounded on all sides by high grounds, must be exceedingly dangerous, from the necessary accumulation and concentration of the poison.

There is reason to believe that the miasm, which produces such deleterious effects upon the animal system, is capable of contributing to the nourishment of vegetables. This, perhaps, is one of the reasons why bilious fevers prevail especially in autumn. The vegetation of spring and early summer is vigorous, and adequate to the consumption of all the products of the organic decomposition that may be going on in the soil. Among other products, the miasmatic exhalations may also be consumed. But, towards the close of the season, when many plants have run their course and begun to decline, they cease to appropriate this as well as other food, which is therefore exhaled, if it do not remain in the soil. Thus, forests also may, in temperate latitudes, contribute to health. Besides protecting the soil from the rays of the sun, and thus moderating the temperature, they may consume miasmatic exhalations, either by absorbing them through their leaves, or by taking up by their roots the rain water which may become impregnated with them as it falls. Hence, the clearing away of woods is often followed, for a short time, by the prevalence of miasmatic disease. In hot climates, however, where the temperature, even in the shade, is abundantly sufficient for the copious developement of these effluvia, forests are thought to do harm by the material they supply for decomposition, the dampness which they promote, and the impediment they offer to the diffusion of the poison, far more than they can do good by their consuming power. The green coating of fungous vegetation, which often covers the surface of shallow and stagnant ponds and ditches, in hot weather, serves probably as a preventive of disease, by appropriating as food the miasmata developed in the soil beneath. It is, therefore, never advisable to remove this scum; and it is not impossible that a violent rain may sometimes do harm by breaking it up. Dr. Cartwright, of Natchez, ascribes extraordinary antimiasmatic properties to the *Jussieua grandiflora*, an aquatic plant growing abundantly in the stagnant waters of the southern sections of Louisiana. He founds his belief on the facts, that the waters which it frequents are perfectly sweet and pure, while those similarly circumstanced, in other respects, are foul, and that the whole region of country inhabited by it is remarkably exempt from miasmatic diseases, though marked by all the characters which are found elsewhere to be most conducive to those affections. The plant derives its sustenance not from the soil, but from the water, and thus consumes all the soluble products of vegetable decomposition as fast as they are formed. (*Western Journ. of Med. and Surg.*, i. 428.)

Diseases, usually the result of miasmata, sometimes occur epidemically, with all the characters of the cases that are obviously of local origin. Whether, in such instances, the cause may be the same as that of the identical endemic affections, it is impossible to determine; for the circumstances in relation to temperature, atmospheric moisture, and the character of vegetation, in the different seasons during which the epidemic has prevailed, have been so variable that no tolerably certain inference can be deduced from them. From the fact, however, that the diseases usually appear at the same season, as well as from their identity of nature, there seems to be good reason for ascribing them to the same malarious influence. But the peculiar condition of things which causes the developement of this influence, over wide regions where it had been before little known, remains quite concealed.

There is another extraordinary, and very important fact, in relation to miasmata, which must not be overlooked. These effluvia are neutralized, decomposed, or in some other way rendered innoxious, by the air of large cities. Though malarious diseases may rage around a city, and even invade the outskirts where the dwellings are comparatively few, yet they are unable to penetrate into the interior; and individuals who never leave the thickly built parts almost always escape. This fact is notorious in relation to the city of Rome; and we have seen it abundantly confirmed in the larger towns of the United States, in the neighbourhood of which these diseases have prevailed. What it is in the air of the city which is thus incompatible with malaria is unknown; but very probably it is connected with the results of combustion; for the fire and smoke of camps are asserted to have had the same effect; and I have been assured by persons inhabiting miasmatic districts of country, that they have been able to protect themselves against the poisonous effects by maintaining fires in their houses during the sickly season.

Of the precise nature of miasmata nothing certain is known. Even their existence has been denied by some. In support of this negative opinion, it is averred that the diseases, usually considered as miasmatic, have often occurred where there were no evidences whatever of vegetable decomposition, as, for example, in argillaceous and dry sandy soils, in mountainous districts, in islands almost destitute of vegetation, &c. For what can be said upon this point, the reader is referred to an elaborate paper by Dr. John Bell, in the *Philadelphia Journal of the Medical and Physical Sciences* (xi. 274), and to another by Dr. William Ferguson, *on the nature and history of the marsh poison*, in the *Edinburgh Philosophical Transactions*. But the facts adduced in denial of vegetable decomposition cannot in their nature be positive; for, even though none may be visible to the observer, yet chemical examination would be requisite to prove the absence of organic matter in the soils; and then the fact, that the effluvia may be conveyed by winds for miles, would render it necessary, in order to establish the negative proposition, not only that no organic matter should exist in the neighbouring soil, but that there should be no source of miasmatic exhalation for many miles around. It is well known that most soils, even when to the eye they show no trace of vegetable matter, yet abound in seeds of various plants, often even at great depths; and peculiar circumstances may lead to their decomposition, and the consequent exhalation of volatile products, though no such result may be obvious. Indeed, the microscope has laid open an otherwise invisible organic world, in which all the changes with which we are familiar in the visible may take place, beyond the cognizance of the senses, and lead to aërial contamination inconsistent with health. In the few instances, therefore, in which miasmatic fevers have prevailed, without an obvious possible source in vegetable putrefaction, we may well infer that such a source nevertheless has existed; because, in the great majority of instances, these diseases can be traced clearly to that cause. So strong, indeed, is the evidence of this fact, that the great mass of observers, ever since the time of Lancisi, have agreed, and still agree, in ascribing the miasmatic influence, whatever may be its nature, to organic, and especially vegetable decomposition. The reader, however, will please to notice that I do not place yellow fever among the proper miasmatic diseases. But, even admitting that fevers, apparently identical with those called miasmatic, have in certain cases originated without vegetable decomposition, it does not follow that they are not in general dependent upon that cause.

Supposing it to be granted that miasmatic influence is the result of some chemical change in vegetable products, we are still far from the solution of the question in regard to its nature. It has generally been considered as dependent on gaseous exhalation; but chemists have never succeeded in satisfactorily demonstrating the existence of any noxious gas in miasmatic air, to which its effects could be ascribed. Carburetted hydrogen is a well known product of marshes; but it is equally well known to be wholly incompetent to the production of miasmatic fever. Otherwise, this disease would be most prevalent in mines, where the gas is most abundant. Professor Daniel detected, in 1841, sulphuretted hydrogen in the water of several African rivers, notorious as the sources of miasmatic effluvia; and it was inferred that this gas might be the poisonous ingredient in the mephitic air of marshes. But the known effects of sulphuretted hydrogen (hydrosulphuric acid) upon the system are wholly unlike those of marsh miasmata; and, were it the cause of bilious fever, that disease ought to be most rife in cities, where the gas in question is most copiously generated. M. Boussingault detected organic matter in the air of marshes, by the agency of sulphuric acid. (*Arch. Gén.*, *2e sér.*, v. 641.) The fact, so far as it goes, gives support to the theory which ascribes the poisonous influence of this air either to animalcules, or to microscopic fungi, which are supposed to find, in vegetable putrefaction, circumstances favourable to their generation from pre-existent germs, and, by entering into our systems, and there propagating, to produce the diseases ascribed to miasmata. Plausible arguments may be adduced in favour of this hypothesis; but it is yet only hypothesis, and can never be established until the existence of such organic beings shall be demonstrated, and experiment shall have proved that they are capable of affecting the system in this particular manner. By Sir James Murray it is maintained that the true malarious agents are "*electro-galvanic currents and accumulations*," which produce disease by disturbing the electrical equilibrium in the body. (*Dublin Med. Press*, Nov. 27, 1844.) But the simple consideration, that such a disturbance is constantly produced, under other circumstances, without giving origin to disease of the miasmatic character, is a sufficient refutation of that hypothesis. At present, we must be content with knowing the malarious influence only by its effects. I have spoken of it as the result of exhalations, effluvia, &c.; but I do not wish to be understood as necessarily expressing, by these terms, gaseous or aëriform bodies. I merely mean by them an emanation, of whatever character it may be, whether gaseous or imponderable, organic or inorganic, simple or complex, which proceeds, under certain circumstances, apparently from vegetable decomposition, and exercises a most powerful and most noxious influence over the well-being of our race. That this influence is not dependent on any state or combination of any known agents, such as heat, cold, moisture, dryness, electricity, &c., is evinced by the fact, that, so far as these agents are concerned, combinations altogether similar to those observed in malarious cases frequently occur without similar effects.

In what manner miasmata operate in producing disease cannot be known until we know their nature. The probability is, that they enter the circulation by means of absorption, and that the chief avenue through which they enter is the air-cells of the lungs. It is not impossible that they may also be absorbed through the skin, and even through the mucous coat of the stomach, which they may enter with the saliva. A full meal, and the stimulant influence of ardent spirit, are supposed to afford some protection against them.

Absorption is probably impeded by these means, and, thus far, they may act as preventives of the malarious influence; but just in proportion to the protection which ardent spirit or other stimulant may yield, during the period of excitement, will be the greater liability to attack when excitement shall be succeeded by depression.

The most striking and characteristic morbid effects of miasmata are intermittent and remittent bilious fevers; but they are believed also to be capable of producing diarrhœa, cholera, colic, dysentery, various hepatic and gastric derangements, and neuralgia. Inhabitants of miasmatic districts are apt, even when labouring under no well-marked and definite complaint, to exhibit signs of feeble health, in their spare habit of body, sallowness of complexion, uncertain appetite, and irregular bowels; and persons are not unfrequently found with enlarged spleen or liver, swollen abdomen, and even dropsical symptoms; but how far these are the direct effects of miasmata, and how far of the febrile diseases which are the acknowledged results of this morbid agent, it would not always be possible to determine. Writers assert that the race is liable to degenerate, under their long continued influence, becoming smaller and weaker in their bodies, and less vigorous in their intellect. (*McCulloch.*) Even the inferior animals are said to be affected by them; and horses and cattle, transferred to miasmatic from healthy regions, are apt to sicken and die. The system, however, becomes habituated to them in time; and individuals who have survived until the middle period of life is passed often live to an extreme old age. It is even asserted that the influence becomes at length essential to health, and that old persons, who have passed their life in miasmatic districts, are apt to sicken upon removal. The inhabitants of such districts are much less liable to malarious diseases than strangers, who are almost always attacked in the sickly season. But, if life is spared for a few years, the susceptibility to the poisonous influence diminishes, and the individual is said to have become acclimated.*

Epidemic Influence.

Occasionally, diseases prevail temporarily throughout a more or less extensive range of country, strikingly different either in their character, or in their modes of approach, progress, and disappearance, from the ordinary complaints of the regions in which they occur. To these diseases the name of *epidemic* is applied, expressive by its etymology of the idea, that they come upon the community (επι upon, and δημος people) from some extraneous source; while the ordinary complaints are called *endemic* (εν in or among, and δημος), because dependent on causes originating among the inhabitants, or within the country itself. The distinction is not very precise; and, frequently, it might be difficult to determine in which of the two classes any particular prevalent disease should be ranked.

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* A peculiar condition of the tongue has been noticed by Dr. Thomas C. Osborne, of Erie, Alabama, which he considers indicative of malarious influence on the system, and which he believes to precede the more obvious effects of the poison. The following is his description of this condition, which he denominates the *malarial margin.* "It is an essential departure from the normal aspect of the edge, constituting a distinct lateral boundary of the tongue, occupying more or less surface according to the charge of infection in the system. Ordinarily, the colour amounts only to a very faint bluish tinge, which is liable to be lost or merged in the various tints imparted to the tongue by various diseases. The most fixed condition of this symptom is an appearance of indentation transversely, which is apparently continued to the subjacent tissue, while the superficial tegument is moist, smooth, and transparent. In a word, it appears to be an encroachment of the inferior surface upon the superior and lateral borders of the tongue, greater as we approach the root of that organ." (*Am. Journ. of Med. Sci.*, N. S., xxii. 555, from *West. Journ. of Med. and Surg.*, Aug. 1851.)—*Note to the third edition.*

It is obvious that an epidemic, as above defined, may proceed from any cause of disease operating extensively, or with unusual violence, upon a whole community; as, for example, from extreme vicissitudes of weather, from the long continued prevalence of cold damp winds, or of heat with moisture, and from miasmatic exhalations when unusually abundant, or carried in unusual directions by steady currents of air. In like manner, the term is often extended to those widely prevalent diseases, which add their scourge to the evils of famine or national misfortune, and arise from the combined influence of insufficient and unwholesome food, depressing emotions, and the noxious exhalations of crowded dwellings.

In all these cases, the source of the disease is obvious, or may be traced with care. But, frequently, diseases of unusual character become prevalent, or those before familiar assume a new aspect, or rage with unwonted violence, without any discoverable cause. These are "the pestilence that walketh in darkness," and "the destruction that wasteth at noon-day." They have been observed as early as the earliest records of medicine; and were naturally attributed by the multitude to the anger of their deities. The more cultivated have vainly attempted to trace their cause. Thus, they have been ascribed to some mysterious influence of the heavenly bodies, especially of the comets; to earthquakes and volcanoes emitting noxious matters into the air; to an altered electrical condition of the atmosphere; and to the rapid propagation and migration of atmospheric animalcules. It is scarcely necessary to say that each of these hypotheses is wholly destitute of proof. Perhaps the most plausible is the animalcular theory, which supposes that these invisible beings, either in the state of germs or fully organized, penetrate into the system, and disturb by their presence the vital processes. There is a strong analogy between the movements of certain epidemics, and those which might be supposed to be the result of animal impulses and caprices, in migrating swarms of insects; for example, at one time, directly onwards with a slow regular march, at another, halting, as if for rest; now in a compact body, with a broad sweeping front, then, again, in detachments diverging from the main line; sometimes leaving no blade of life unvisited, and again passing over large tracts untouched, and settling down devouringly on some distant and isolated spot. This theory also enables us to explain certain anomalies in the propagation of epidemic diseases, which have often embarrassed pathologists; how, for instance, with strong evidence of their non-contagious nature, they should sometimes appear to be spread by the movements of men, individually or in bodies, from infected neighbourhoods to others before untouched. The living germs, carried in clothing or merchandise, may find a congenial atmosphere in the new locality, and, propagating with the rapidity characteristic of insect life, may soon infect the whole vicinity. Other analogies are offered in the receding of the visitation, often as rapid as its approach, the occasional lingering of deserted fragments of the moving host in isolated neighbourhoods, and the subsequent temporary and relatively feeble revival of the pestilence, sometimes observed, as though organic germs had been left behind to struggle into a short course of activity and propagation, under unfavourable circumstances. They who desire to prosecute this inquiry may advantageously consult the "*Medical Notes and Reflections*" of Dr. Holland, who has fully considered, and seems disposed to adopt the animalcular theory. Like the other explanations, however, of the cause of epidemics, it must be looked upon, in the present state of our knowledge, as purely hypothetical. It is highly probable that there are unknown influences, atmospheric, terrestrial, or both, which are as essential to the sound state of our vital functions as those which are known, and the perversion of which must consequently occasion disease. Such may possibly be the origin of epidemics. The recent discovery of a peculiar atmospheric condition, ascribed by some to the presence of a principle called ozone, has given origin to various conjectures as to its morbific agency; but as yet they are nothing but conjectures. It is, indeed, vain to speculate upon this subject. All that we can say, with certainty, is, that there must be some distempered condition of the circumstances around us, some secret power that is operating injuriously upon our system; and to this we give the name of *epidemic influence*. But, though we know nothing of the origin, or essential nature of this influence, we can observe and study its effects, and thus deduce the laws which appear to regulate its operations. The following are some of the laws alluded to. It would not be amiss to consider as epidemics only the diseases which originate in, or are affected by, the influence alluded to; and the observations which follow may be received with this limitation.

1. This influence frequently gives rise to diseases, quite independently of any other known cause, as in the case of the influenza, of cholera, and of the typhous epidemic of 1812–13, &c. But it still more frequently exhibits itself in giving increased energy to other causes, enabling them to produce particular diseases, under circumstances differing from those in which they are ordinarily produced, and to an extent not attainable without its aid. Thus, smallpox, scarlatina, and other contagious eruptive affections, sometimes become epidemic. Whether the epidemic influence is alone sufficient to produce them, without the co-operation of the specific contagion, is perhaps questionable. It is highly probable that it may be so; as these diseases occasionally occur epidemically, without any known communication between the individuals first attacked, and others previously affected. This being admitted; still, the epidemic influence is chiefly felt in giving to the system a stronger predisposition to the disease than exists under other circumstances; so that, though persons may generally escape by carefully avoiding the specific cause, yet many are now attacked who may have been frequently exposed to the contagion on former occasions without effect; and the complaint often assumes a more violent character than belongs to it in ordinary years. Sometimes the epidemic influence predisposes to some one especially of the exanthemata, as to smallpox on one occasion, measles on another, &c.; sometimes, the tendency seems to be towards eruptive diseases in general, so that all the exanthemata are more rife than usual, and occasionally new and anomalous forms of eruption appear.*

The same remarks are true of typhus fever. Sometimes true typhoid epidemics occur without any known cause. On other occasions, the epidemic influence co-operates with the ordinary causes of the complaint, giving it a wider extension and greater malignity. It now occurs in confined and crowded places, which had before escaped. Thus, too, the typhus resulting from a general famine, and the depressing influence of national calamity, may become aggravated by an epidemic influence, and be converted into a terrible pestilence. It has been thought that the same cause which predisposes to this form of disease, may also affect the crops unfavourably, so as to occasion famine; and the coincidence of famine and pestilence is thus further accounted for; but our information upon the subject is too vague to justify a positive opinion.

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* A remarkable exemplification of this statement is offered in the *furunculoid epidemic* which has recently prevailed both in Europe and this country, beginning probably so early as 1849, reaching its greatest height in 1852, and still continuing, though in a greatly diminished degree. Every practitioner must have been struck with the extraordinary prevalence in 1852 of boils or furuncles, carbuncles, whitlows, and other pustular affections of the outer surface of the body.—*Note to the fourth edition.*

Miasmatic diseases may, in the same way, become truly epidemic; not that they directly result from this concealed influence; but that the predisposition to them is greatly increased by some unknown cause; so that an amount of miasmatic exhalation, more or less of which may be always floating in the air in warm weather, may now produce its peculiar effects, which, in ordinary seasons, would be wholly unfelt. Hence, probably, the late prevalence of intermittent and remittent fevers, during the summer and autumn, in portions of the Middle and Eastern States, in which these diseases were formerly almost unknown; while the circumstances of these regions, in relation to the production of miasmata, remained, so far as could be discovered, the same as in preceding years.

2. Sometimes the epidemic influence is felt, rather in giving a certain type or direction to existing diseases than in rendering any one disease especially prevalent. Thus, at one period, a low or typhoid tendency is given to most diseases, so that they will not bear depletion; at another, an inflammatory character is impressed on them, requiring the lancet. Thus also, a particular direction may be given to particular organs; for example, in one season to the head, in another to the chest, and in a third to the alimentary canal. Hence the important practical inference, that the physician should not allow himself to become wedded to any one plan of treatment, in diseases apparently identical; because, under varying circumstances, they may put on characters demanding very different and even opposite modes of management.

3. One of the established laws of epidemics is, that they give more or less of their own character to all other diseases. Thus, when cholera prevails, looseness of the bowels is very apt to be superadded to other affections; when influenza, all other complaints become complicated with catarrhal disease. Under such circumstances, the accidental or endemic diseases are said to wear the livery of the epidemic. The result is nothing more than might have been anticipated. The morbid cause is universal, and operates more or less upon all. Many, however, while in perfect health, are able to resist it, and exhibit no morbid phenomena. But, if attacked with disease from some other cause, they lose, in some degree, this power of resistance, and yield to the epidemic influence, which, without superseding the existing affection, modifies it by superadding its own peculiar effects.

4. The epidemic influence is sometimes confined within a narrow space, sometimes affects extensive regions, and sometimes encircles the globe. When it pervades a large portion of the earth, it is never present everywhere at the same time, but attacks different parts successively; in some instances advancing regularly, and sweeping all before it, in others, irregular and discursive in its progress, and leaving many places untouched; occasionally rapid almost as the wind; and then again exceedingly slow, creeping, as it were, from one point to another, and occupying years in spreading over one extensive district. Opposing currents of wind do not obstruct its course; and this fact has been advanced as one of those favourable to the animalcular theory.

5. It often gives warning of its approach by some change in the character of prevailing diseases, by the occurrence here and there of a case analogous to the epidemic disease, or by a general tendency to slight affections of a similar character. Thus, the breaking out of cholera is often preceded by a general tendency to moderate diarrhœa.

6. But the first effects of the cause, when in full action, are usually the most violent. At least, the cases which first occur, though comparatively few, are more malignant and of greater proportionate fatality than those which

appear subsequently. This, perhaps, may be owing to the greater susceptibility of those first attacked. The most susceptible are of course the first to feel the morbific influence, and might be expected to suffer most from it. The proportion of fatal cases diminishes with the increased prevalence of the disease; until at length, before its disappearance, it becomes disarmed of much of its malignancy, and is often converted into a comparatively mild affection.

7. The epidemic influence sometimes disappears entirely after a short prevalence, sometimes continues, with irregular intermissions, for two, three, four, or even six years, and occasionally even longer. Thus, the influenza often vanishes entirely after a continuance of some weeks; but, in some instances, returns again when it appeared to have been about to take its final leave, and rages with all its original violence. Cholera often visits the same place a second time, in the next or some subsequent year; and in India, after its epidemic prevalence, appears to have taken up a fixed residence, and almost to have become endemic. The miasmatic epidemic which made its appearance in the year 1820, in the neighbourhood of Philadelphia, and recurred annually for many years, left traces behind it which have scarcely yet ceased to be visible.

8. It has been a subject of frequent observation, that a certain epidemic tendency, after continuing for several years, will be followed by another of a different kind, which in its turn will give way to the former tendency, or to a third different from either; a short period of unusual exemption from disease intervening, in each instance. Thus, from the year 1793 to 1807, there was a tendency to severe bilious or miasmatic diseases in this vicinity; the yellow fever prevailing occasionally in Philadelphia, and bilious fever in the country. An interval of comparative health followed. In the winter of 1812–13, the typhous epidemic made its appearance; and its influence upon the character of diseases continued to be felt as late as 1818 or 1819. In the summer of 1820, the typhous tendency was superseded by the miasmatic, and the occurrence of yellow fever in the city, and bilious intermittent and remittent in the country, marked the change. Though the yellow fever scarcely recurred after that season, yet the miasmatic fevers of the country continued to prevail for many years; and it was not until 1836, that typhus fever again prevailed among us, and then only to a very moderate extent. After that period, we may perhaps be considered as having enjoyed an interval of comparative exemption; but the miasmatic fevers recurred, and have since continued in a greater or less degree, though, during the year 1851 and subsequently, they appear to have given way considerably to the typhoid fever, which has been prevalent in this district of country, as in other parts of the Union. These remarks have reference only to the two epidemic constitutions especially alluded to. Epidemic tendencies to eruptive affections seem to run in somewhat similar, though not coincident cycles. Thus, after the introduction of vaccination, the smallpox seemed for many years to be almost entirely subdued, because no epidemic influence was superadded to that of contagion. We are now, and have been for more than twenty years, in the midst of an epidemic variolous cycle; and the disease has seldom been entirely absent from among us. From the experience of the past, we may look forward with confidence to a period of renewed exemption, when vaccination will again assert its complete supremacy.

9. The lower animals appear to be affected by epidemic influences, and seasons of unusual fatality among them have coincided with those in which the human race have suffered; but how far the effects are the same as upon man has not yet been accurately determined.

Contagion.

By this term, as expressive of a morbific cause, is meant any product of a peculiar disease, which is capable of producing the same disease in another person, and of thus propagating itself, and the complaint of which it is at once the cause and the effect, through any number of unprotected individuals. The disease thus propagated is said to be *contagious*. The terms *infection* and *infectious* are generally used in a similar sense, though perhaps with this difference, that these designations are limited most frequently to the cases in which the morbid impression may be received through the atmosphere; while contagion and contagious are applied indiscriminately to these, and to cases of propagation by contact. Thus, we speak of the infection of typhus fever or smallpox, and call these infectious diseases; but do not commonly apply the same terms to syphilis or the itch. All these diseases, however, are contagious, and their cause contagion. It is true that some authors employ infection in a different sense. Thus, Chomel confines it to the action of the morbific exhalation which arises from the person, when numbers, either in health or sickness, are crowded together; and the resulting diseases he calls infectious. In this confusion of meaning, it is best to abandon the terms infection and infectious altogether, especially as we can express all that is essential without them. The participle *infected*, however, may be used, in a general sense, to imply the condition of being tainted, or injuriously affected with certain qualities; as we say that the atmosphere is infected when it is loaded with the cause of disease, and that a locality, or district, is infected, in which such an atmosphere prevails.

Contagion is usually the product of secretion or exhalation, and may be either in the solid, liquid, or aëriform state. In the first two conditions, it acts either by simple contact, as in syphilis and gonorrhœa, or by application to a wound or abraded surface, as in hydrophobia and vaccination. In the aërial state, it acts through the medium of the atmosphere, probably for the most part by inhalation into the lungs. In all its forms, it undoubtedly operates through absorption, so far as constitutional effects are concerned. In certain instances, however, it appears to be confined to the surface affected, without contaminating the system. Such is the case in porrigo and scabies. Some diseases are contagious exclusively by means of contact or insertion, as syphilis, hydrophobia, and the vaccine disease; others possibly through the air alone, as hooping-cough, scarlatina, and typhus; and others again in both modes, as smallpox, chickenpox, and, as some assert, measles. Indeed, it is by no means certain that all the febrile contagious diseases might not be propagated by inoculation, were we acquainted with the proper matter to apply in each case.

The contagious matter may be the product of local action in the diseased individual, as in syphilis, scabies, and porrigo, or may be connected with a general contamination of the system, and exhaled from all the free surfaces of the body, as in smallpox, scarlatina, measles, and typhus. It has no sensible properties by which its poisonous character might be indicated, nor does it yield any evidence of its nature to chemical investigation. In some diseases, as in smallpox and typhus fever, it is often attended with a disagreeable odour; but it is by no means certain that it is the matter of contagion itself that smells. In other instances, it is without odour, as in measles and hooping-cough.

There is a great difference in the contagious power of the different exhalations. In some, it is feeble, and attacks few comparatively of those exposed to it, as in scarlatina; in others, very active, allowing few that are unprotected to escape, as in smallpox. Contagion does not usually act at a great distance from its source, though there is considerable difference also in this respect. Thus, typhous contagion seldom extends beyond a few feet in well ventilated apartments; while the variolous will not unfrequently spread through all parts of a house from a single bed, and even from one house to another in the near vicinity.

The effluvia are capable, in some instances, of attaching themselves to clothing, merchandise, &c., and may thus be conveyed to great distances. It very rarely happens, however, that the mere entrance into the sick room is sufficient so far to impregnate the clothing, as to enable the wearer to become the instrument of spreading the disease. Hence, we scarcely ever hear of a physician conveying the complaint from one person to another. Still, it would be prudent, in a practitioner attending upon very contagious diseases, such as bad cases of smallpox, to change his dress before visiting another patient. Instances not unfrequently occur, in which contagion is imparted by the clothes or bedding of a patient, or of persons in constant and close attendance upon him. Disease has thus been carried to very considerable distances, and caused to spread in places before uninfected. Fabrics of wool, silk, and cotton, are especially liable to act as fomites; but those of flax and hemp are not exempt. Hair may also serve as a vehicle. The greatest danger is when boxes, containing clothing thus infected, are first opened. Insects have been suspected of conveying the contagion by alighting successively on the body of the patient, and on that of a susceptible individual. Fomites will often long retain the poison, though it is weakened and at length destroyed by time. It is always safest to act upon the supposition, that the period of its activity is indefinite, unless measures are taken to destroy it by chemical agency.

The matter of contagion is said to be rendered inert by a heat of 120° F., and consequently by any higher degree. Hence, the boiling or baking of infected clothing should render it harmless. Intense cold is thought also to impair the activity of the contagious matter. Nevertheless, diseases of this class occur more abundantly in winter than in summer, owing, no doubt, to the confinement which is necessary, in the former season, to guard against the cold, and the consequent concentration of the morbific agent. Certain chemical substances have the power of completely decomposing contagious matter, especially chlorine, which is, therefore, much used for the purpose of disinfection. Its activity is also gradually impaired by time. It is said that the virulence of the poison is diminished by transmission through numerous individuals; and one contagious affection at least, namely syphilis, would appear to have become milder by time; but the correctness of the general statement may well be disputed.

The time at which a contagious principle begins to show its effects varies from two or three days to several weeks, after exposure. The resulting diseases are generally febrile, especially when the contagion is of the kind transmissible through the atmosphere. The effect of certain contagious principles on the system is essentially depressing, as that of typhus; and, in general, their direct operation is rather sedative than inflammatory; though this is by no means uniformly the case. The manner in which the disease spreads is peculiar, and often affords the requisite criterion of its contagious nature. Thus, it does not at once seize upon great numbers, as an epidemic, or occur in several separate points within a given space at the same time, like an endemic; but spreads from individual to individual, or from house to house; and, when new cases occur at a distance from the original one, they can often be traced to it by the intervention of persons or fomites. Instead of originally seizing a whole family, or several members of it, at one time, it generally first attacks a single individual, and, from two or three days to two or three weeks afterwards, several others almost simultaneously.

The febrile contagious diseases generally run a certain course, having distinct stages at certain intervals, and terminating in a given number of days. This property is not absolute; but is so general and striking as to be characteristic.

Another peculiarity of the same set of diseases is, that one attack in general secures the system against a second. This rule, however, is liable to frequent exceptions. It does not apply to the complaints imparted exclusively by contact. Indeed, one attack of syphilis is said to predispose to a second.

There seems to be a certain incompatibility between the several contagious febrile complaints; so that, if an individual has been exposed to the causes of two of them, he will not usually be affected simultaneously with both; but one will run its course, and, when it begins to decline, the other will appear; or the feebler one, if it have precedence, will be superseded for a time by the more powerful, and will return and finish its course, after the latter has subsided. Such is the case with measles and smallpox. Occasionally, however, we see two of these complaints apparently existing together, and modifying each other, as in the cases of measles and scarlet fever.

A common character of all contagious diseases, and, indeed, the one that renders them such, is the power of reproducing the same kind of matter as that by which they were brought into existence. Nevertheless, it may be said that this rule is not absolutely universal. Thus, it is very doubtful whether the matter of hydrophobia can be reproduced in the human subject. A sufficient answer would be, that, if it cannot be reproduced, hydrophobia is not a contagious disease so far as man is concerned.

Many, perhaps all, of the contagious diseases may arise from other causes than their own peculiar contagion, and may afterwards propagate themselves in the ordinary mode. This is very commonly the case with typhus fever. There is often an epidemic tendency to certain contagious diseases, which, under such circumstances, may, I believe, originate without other influence. Such a tendency, moreover, greatly increases the activity of the contagious cause; and it not unfrequently happens, during its prevalence, that persons before supposed to be sufficiently protected are attacked a second time.

The contagious affections of inferior animals are sometimes imparted to man, though probably somewhat modified. The vaccine disease, hydrophobia, the glanders of horses, and perhaps the malignant pustule, are examples of this kind.

The nature and mode of action of the contagious principles are points of great interest, which remain yet to be settled. There are two circumstances which serve to distinguish them from other morbific agents, and which especially merit notice. These are their power of reproduction in the human system, and the immunity which one attack generally gives against their future influence. In this latter circumstance, there is a striking difference between them; for, while most of them obey the general law just stated, others, such as the contagions of syphilis, gonorrhœa, psora, and porrigo, are capable of affecting the same individual as often as they may be brought into contact with him.

Two theories have been advanced to explain the action of these causes. By one they are considered in the light of ferments, which, entering the bloodvessels, occasion chemical changes, that result in a further production of similar contagious matter; as the fermentation of beer developes an additional quantity of the same kind of yeast, by the presence of a little of which it was excited. This explains the reproduction of the morbific agent. An attempt has been made to account for the fact of future exemption by supposing that, in every system, there exist, as consequences of the organic processes of growth, peculiar matters, each one of which, through the fermentation excited by the contagious cause, is itself converted into contagion, and eliminated; so that, on any future occasion, though the poison may be absorbed, it will find no material to act on, and will therefore be harmless. An explanation so purely hypothetical scarcely requires criticism. The objection naturally suggests itself, that there should be so many distinct unnecessary substances, generated and retained in the system, as if with no other purpose than to await the action of certain special morbific principles, to be received from without. A more plausible explanation of the future exemption is that given by Mr. Paget. Each organized structure has the property of assimilating to its own nature, the material presented to it in the nutritive process. Thus the bony tissue converts the organizable material into bone, muscle into muscle, &c. The blood itself is in the same category, being capable of assimilating nutriment to its own nature. Should a structure become diseased, it assimilates the material, not to its original, but to its altered condition. Tumours, upon this principle, retain their character as they increase in size. In like manner the blood, which, under the influence of absorbed contagious matter, undergoes some modification which renders it no longer susceptible to the influence of the contagion, maintains its new condition and of course a continued insusceptibility by the principle of assimilation. (*Lect. on Surg. Pathol.*, i. 51.)

The second theory considers contagion as the influence of certain invisible organic agents, either animal or vegetable, which, fully developed, or in the state of germs, enter the blood-vessels, and there live and propagate to the no little disturbance of the system, which is at length excited into desperate efforts, and throws off the intruders and their whole brood, or perishes in the attempt. In support of this view, the argument has been advanced, that, in certain cutaneous affections, as porrigo, the cause has been proved to exist in microscopic fungi, the sporules or seeds of which become the medium of contagion; and, in the case of psora, the disease is conveyed by animalcules of a peculiar character, which propagate in the skin. But the fact that, in these affections, no future exemption is secured, shows that they are essentially distinct in nature, and probably in cause, from the febrile or general contagious diseases; and there is nothing in the animalcular hypothesis, which affords even a plausible explanation of the immunity, secured by one attack of these latter complaints.*

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* *Zymotic Diseases.*—The term *zymotic*, applied to a class of diseases, and sometimes to their cause or causes, has come so extensively into use as to require some explanation in a general treatise like the present. It is derived from the Greek word ζύμη, ferment, and is applied to a certain set of diseases, in which it is supposed that a morbific agent, entering the blood, operates upon it as a ferment, as yeast for example operates upon saccharine juices. A minute quantity of the poison sets on foot an action in the blood, by which the whole mass is changed; and the resulting phenomena proceed from the altered state of the blood, and not from the direct agency of the foreign matter admitted into the circulation. Upon this principle it is thought that all those causes operate which are included, in the text, under the names of *animal effluvia*, *miasmata*, *epidemic influence*, and *contagion*. They would be called, under this theory, *zymotic agents*; while the diseases produced by them are called *zymotic diseases*. Of course, under the latter title, are included all miasmatic or malarious fevers, all epidemics, and all contagious diseases resulting from an absorbed poison. The reader will notice that this view of the operation of certain causes of disease is purely hypothetical, being founded altogether on certain analogies which in themselves are not complete, and unsupported by chemical or microscopic observation. The hypothesis is plausible, and

Predispositions.

Before leaving the subject of etiology, it is necessary that we should notice certain influences, which, though not always strictly causes, have yet an important agency in the production of disease. I have already spoken, in general terms, of the distinction between predisposing and exciting causes; and have considered somewhat fully such as seemed to require particular attention in a general treatise. At present, my object is to speak of the predispositions, in other words, the states of system which render it especially liable to the assaults of disease. These may be arranged in three divisions. The *first* includes certain conditions which are not in themselves deviations from health, and might with great propriety be denominated, after Chomel, *aptitudes*. To the *second* belong those states of system, not strictly healthy, which predispose to no one peculiar disease exclusively, but rather to some set of diseases, some general mode of derangement, or to almost any disease, according to the nature of the exciting cause. The *third* embraces what are usually denominated *diatheses;* that is, tendencies to some one special and peculiar disease, which is apt to appear whenever the body is excited or disturbed, no matter by what cause, and will occasionally break forth without any apparent cause whatever. These may indeed be considered, in some instances at least, rather as latent conditions of the peculiar disease, than as mere predispositions. Such are the gouty, the rheumatic, and the scrofulous diatheses. The proper place to treat of these is obviously in connexion with the several affections to which they belong. It is only the first two divisions which require particular notice in this place. Among the *aptitudes*, we may consider *temperaments*, *idiosyn-*

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to a certain extent may be true, but has not been proved, and should not, therefore, I think, be made the basis of a new classification or new nomenclature of diseases. The effect of such classification and nomenclature, if generally adopted, is to lead the student to receive as admitted fact, what is yet simply conjecture.

In the text, allusion is made to a mode of explaining the peculiarities of contagious diseases upon the principle here referred to. Liebig teaches that fermention is owing to a movement of decomposition excited in one body by the mere presence of another body undergoing decomposition. Yeast is a nitrogenous substance in this condition. Introduced into a pure saccharine solution, it sets on foot a process of decomposition which results in the formation of alcohol and carbonic acid out of the sugar, without further change; but, if along with the sugar and water there be a nitrogenous body, as in the infusion of malt, this body undergoes, through the same agency, chemical changes which convert it into a substance having all the properties of the yeast originally employed. So in contagious diseases, a little of the zymotic agent, itself in a state of chemical change, entering into the blood, and finding there some material susceptible of its influence, sets on foot a process of decomposition in that material which ends in its conversion into a similar zymotic agent, to be thrown out of the system.

Dr. Carpenter has ingeniously extended this theory to the explanation of the predispositions to the epidemic or zymotic diseases, which, as is well known, are apt to attack only a certain number of the individuals exposed to their influence, while many escape. In reference to cholera, for example, it is those who have lived miserably, in confined places, and in a contaminated atmosphere, who are most apt to suffer. He supposes that in these persons the blood has become contaminated with absorbed or generated nitrogenous matters, in a state ready to enter into decomposition with great facility upon the application of the ferment. In these, therefore, the absorbed poison excites the movement of decomposition which gives rise to the morbid phenomena; while pure blood, offering no such material for the action of the poison, undergoes no change, and the individual escapes. The reader who is disposed to push this inquiry farther is referred to an article on *the predisposing causes of epidemics* in the *British and Foreign Medico-Chirurgical Review*, for January, 1853. All these speculations, however, should be looked on as suggestive merely, prompting to positive experimental research, and should not be received as truths until established by the results of such research.—*Note to the fourth edition.*

crasies, *sex*, and *age*; among the predispositions, *hereditary tendencies*, *habit*, the effects of *climate*, and the results of *occupation* and *modes of life*.

1. *Temperaments.*—Scarcely an individual, probably, can be found, whose organization is so well constituted, and so nicely balanced, as not to offer an aptitude to some particular disease or mode of derangement, rather than to another. Almost all have some deficient or predominant tissue or organ, some weaker or stronger susceptibility, some inequality of function, or some peculiarity of sympathetic relation, which favours the action, or gives speciality to the direction of some morbific cause. These constitutional peculiarities, when they are such as affect classes of persons, are called temperaments, when confined to individuals, idiosyncrasies.

The general rule, in relation to the temperaments as predispositions to disease, is, that a predominance either of developement or function, in any structure, organ, or system of the body, is apt to lead to disease of that part. Thus, the *sanguine temperament*, in which the circulatory system predominates, predisposes to acute inflammations, hemorrhages, and fevers of a sthenic character; the *lymphatic temperament*, which is characterized by an excess of the colourless tissues, and deficiency of red blood, to scrofulous and dropsical affections; the *nervous temperament*, in which the cerebro-spinal system is in excess, or peculiarly excitable, to neuralgia, and the various forms of nervous disorder; and the *bilious temperament*, the name of which sufficiently indicates its character, to hepatic and dyspeptic diseases.

2. *Idiosyncrasies.*—These are highly important. Many persons have peculiarities, either confined to themselves, or participated in by very few, which render them susceptible to morbid impressions from causes, which in general either produce no effect, or one entirely different. These are not indicated by external signs, and are to be ascertained only by experience. Thus, certain kinds of food, usually very wholesome, may produce violent urticaria. Exhalations; which are quite harmless to the great mass, excite, in certain individuals, excessive irritation of the nostrils, fauces, or respiratory passages. Some very susceptible persons faint at the perception of odours, usually agreeable in their effects. So frequent are these peculiarities, and sometimes so important, especially in relation to the operation of medicines, that the physician should make himself acquainted with the constitution of every new patient, as far as practicable, before prescribing for him, in any serious case. Inferences as to the morbid liabilities of individuals may sometimes be drawn from the shape or size of their organs.

3. *Sex.*—This has great influence in giving peculiar morbid tendencies. Of course, each sex is prone to the diseases belonging to its own organs and functions. But, independently of these, women, in consequence of the greater excitability of their nervous system, are especially predisposed to nervous complaints; and causes, which in men produce inflammation, will in them give rise to mere functional disorder. Thus, gout and rheumatism, instead of assuming a frank inflammatory character, are apt to lurk in the female system, under the forms of dyspepsia, palpitations, headache, and neuralgia in every shape. From the same cause, women are especially liable to spinal disorder, and to all the protean forms of hysteria. Their sexual peculiarities also impress on the general system predispositions, not immediately or necessarily connected with the several organs. Thus, about and soon after the age of puberty, they are strongly prone to chlorosis or anæmia. Child-bearing, though liable to its accidents, is probably on the whole favourable to health, by superseding constitutional morbid tendencies. But, when menstruation has permanently ceased, these tendencies are apt to display themselves; and this, consequently, is the most dangerous period in the life of woman. It is now,

especially, that cancerous affections occur. But if she escape the dangers of this period, she may reasonably hope to enjoy a long exemption from disease, and to live on to a good old age. Much of the peculiarity, ordinarily observable in the female predispositions, is owing rather to their habits than to any natural cause. Hence, probably, in part, their tendencies to spinal deformity, pulmonary consumption, anemic complaints, and dyspepsia.

4. *Age.*—In consequence of the early developement of the brain, and the exposure of the skin to a new and unaccustomed medium, very young infants are peculiarly predisposed to cephalic and cutaneous diseases. The rapid growth of the body, requiring a vigorous exercise of the digestive organs, afterwards makes these also a centre of morbid action. The process of dentition keeps up, during its continuance, a constant irritation, which, through the fresh and unimpaired sympathies, extends to the various functions, especially those of the skin, alimentary canal, and brain, giving rise to frequent diseases of these parts. Vast numbers of children are carried off by complaints of the stomach and bowels, during the period of teething. The almost unremitted excitement of the nervous system, either directly from the source of irritation, or as the instrument of all the sympathies, renders this system more liable to derangement than at any other period of life; and causes which are ordinarily little felt now frequently produce convulsions. By far the most dangerous period of life is before the close of the third year. There is another source of danger, which continues in operation until after the completion of the second dentition. In the inflammatory affections of children, at this age, there is a strong tendency to the exudation of coagulable lymph, and the consequent formation of false membrane, even upon the mucous surfaces. Perhaps this may be owing to a predominance of fibrin in the blood, consequent upon the wants of the nutritive process; but the explanation is altogether conjectural. It is this disposition which renders croup so fatal at the age referred to. After the second dentition, until the age of puberty, is among the healthiest periods of life. Children are now scarcely predisposed to any other occasional affection than epistaxis. They are, however, often exposed to the influence of the aërial contagions, such as measles, scarlatina, and hooping-cough, because they are old enough to be frequently abroad, and have not yet generally acquired the exemption which secures them in later life. The age of puberty is not peculiarly liable to any disorder in the male; but, in the female, is not unfrequently accompanied with derangements of the uterine functions, and of the general health, which may continue for years. Chorea, chlorosis, and hysteria, often have their origin at this period. With the exception alluded to, the healthfulness that succeeds the completion of the second dentition, continues onward until near the age at which rapid growth ceases. At the latter period is another dangerous crisis. There is now a strong predisposition to hemorrhages, pulmonary consumption, and dyspeptic affections. The quantity of blood furnished by the digestive process has not yet become exactly accommodated to the diminished wants of nutrition, and hence is apt to escape by irregular outlets. Perhaps the peculiar liability to phthisis may be explained by the same necessity for extravasation, which, in persons of the consumptive habit, takes the form of tuberculous deposit. The appetite, or at least the habit of eating, has not learned to adapt itself to the moderated powers of digestion, and the stomach is apt to be overworked. After maturity, when the body has attained its full expansion, and growth has ceased, there is again a period of comparative exemption from morbid tendencies, which continues, with the exception, in females, of a few years about the cessation of the menses, until life begins to decline. The functions are now all well balanced in the healthy individual; no organ is called on for an excess of duty; and none,

therefore, is especially liable to derangement. But, when the period of decline has arrived, the balance is again disturbed, one organ fails too rapidly, another retains a disproportionate activity, and the general hardening of the tissues, incident to age, goes on with an unequal, and sometimes a dangerous speed. Hence, predispositions to various organic diseases accrue; and the brain, the heart, and the urinary and genital organs, are especially prone to suffer. In the degeneration of tissue that takes place, the characteristic properties of the ultimate cells are sometimes perverted or lost; new laws regulate the nutritive process; and thus morbid growths are apt to be developed, such as scirrhus or cancer, which, though not exclusively, is especially a disease of advanced life.

5. *Hereditary Tendency.*—As we often resemble our parents in external form, so also do we inherit their internal peculiarities, and consequently all the morbid tendencies growing out of them. It is not diseases, generally speaking, that are inherited. It is only the peculiarities of structure or constitution, which serve as predispositions to disease. We are not born with the scrofula, gout, rheumatism, &c., of our parents, but only with that condition of system which favours the developement of these affections, when other causes operate. The inherited diathesis, however, is often sufficiently strong to lead ultimately to the disease, without other cause. We see this fact constantly illustrated in consumption and gout. Nay, the hereditary disease will often be developed, notwithstanding the most determined measures to prevent it, which sagacity and experience can suggest. The inheritance may descend from either parent or both. It has been supposed that the peculiar diseases of the mother are more apt to be found in the son, and those of the father in the daughter; but the accuracy of the opinion may be doubted. When only one parent is affected, it often happens that the offspring escape entirely, taking after the healthy parent exclusively. But when both are diseased, and in the same way, the chances of escape on the part of the children are greatly diminished. Hence the danger of constant intermarriages between near connexions, who may be supposed to have the same defects of constitution. The morbid tendencies thus go on accumulating, from generation to generation, until families, and even races, become extinct. Sometimes the hereditary malady passes over one generation, to fix upon the next. The child escapes, but the grandchild is affected. This fact admits of easy explanation. It is only the tendency that is received from the parent. This may remain latent, from the absence of causes calculated to call it into action; or counteracting circumstances may exist which shall prevent its developement. The tendency is, nevertheless, handed down to the next generation, which may be less fortunate in relation to the influences that bear upon it. Occasionally, we observe, family predispositions to disease, which have no prototype in the immediate, or even remote ancestors. One child after another falls a victim to the same disease, from some inherent vice of constitution; and parents, themselves of sound health, may thus be completely stripped of their offspring. This sometimes happens from a vicious system of physical education, and is much more frequent among the rich than the poor. But, in other instances, the defect is received from the parent, and exists from birth. In such cases, however, the disease cannot, in strictness, be said to be hereditary. Complaints dependent on inherited peculiarities of system, are apt to appear earlier in life than similar complaints of a different origin.

6. *Habit.*—The influence of this principle is generally salutary. The system, frequently exposed to morbific causes, may be reconciled to them in the end, and cease to receive further injury. Persons thus become acclimated in unhealthy districts, and sometimes, when brought up in such districts from

infancy, are gradually accustomed to the noxious influence, and appear not to suffer. Occasionally, however, habit constitutes a predisposition to disease. Thus, when the system has adapted itself to certain influences, ordinarily injurious, they may become necessary to health; and an exposure to circumstances, incompatible with their continuance, may lead to disorder. Hence an important practical rule, to withdraw individuals cautiously, and by degrees, from a long accustomed exposure to what may even be deemed injurious agencies, unless immediate danger is apprehended from them, or no other than a sudden breaking up of the dangerous habit can be effectual.

7. *Effects of Climate.*—These frequently constitute predispositions to disease. In hot climates, the liver and its appendages are kept in an undue state of excitement, both from the direct stimulant influence of heat upon that organ, and from the additional duty which it has to perform in the elimination of carbonaceous matter. A certain excess of carbon is introduced with the food, which is thrown off partly by the lungs and skin, in the form of carbonic acid, partly by the liver in the form of fatty matter. That part of it which is converted into carbonic acid, answers the additional purpose of affording animal heat; but, as little of this is needed in hot countries, there is less of the acid formed, and a greater proportion of carbon must consequently escape by the liver. This organ is, therefore, overburdened with duty, while the lungs are spared. Hence is established a predisposition to biliary and gastro-intestinal diseases; and those of the lungs are comparatively rare. In cold climates, the facts of the case are exactly reversed. Animal temperature is here especially wanted, and the carbon consequently finds its chief outlet through the pulmonary organs; the liver having proportionably less duty to perform. Under these circumstances, hepatic affections are rare; while a strong predisposition exists to diseases of the lungs. In temperate latitudes, there is less exclusive tendency of disease to any one organ; but, in consequence of the frequent vicissitudes of weather, and the consequent varying conditions of the organs, there is a greater general tendency to inflammatory affections. The vicissitudes are felt more strongly when the climate is damp as well as variable, and the morbid tendency is also consequently stronger. Rheumatism and catarrhal affections are the most frequent results. In warm moist climates, the system is depressed by the sedative influence of the moisture, and a predisposition to low forms of disease is established. A hot dry climate is said to predispose to diseases of the skin. Of the effects of impure air, as that of cities, for example, enough has been said on a previous occasion.

8. *Effects of Occupation, Modes of Life, &c.*—The predispositions which flow from these causes are very numerous. It is, however, impossible, in a general view like the present, to follow them in all their ramifications. They may generally be estimated by a reference to the various causes of disease already enumerated, and ascertaining their bearing in each particular case. A few remarks on the subject of diet, dress, and employments, whether of business or pleasure, will close this essay.

The habitual use of animal food in excess produces a superabundance and richness of the blood, which strongly predisposes to inflammatory diseases, especially when a corresponding amount of exercise is not taken. An exclusive vegetable diet may, on the contrary, impoverish the blood, and occasion a general debility, predisposing to scrofulous and tuberculous affections, and various nervous derangements. Scanty and unwholesome, or putrid food, vitiates at once the fluids and solids of the body, and predisposes to scurvy and low forms of fever. Stimulating drinks and condiments favour directly the causes of irritation, and, by the relaxation which follows their use, lay the system open to the assaults of morbific causes in general.

The predispositions produced by dress resolve themselves into those resulting from heat, cold, and pressure, according as the clothing is too abundant, too scanty, or too tight.

So far as the predispositions resulting from occupations of all kinds, including the pursuit of pleasure, are concerned, there are two prominent considerations to be kept in view; first, that over-exercise of the organs, by rendering them the centre of vascular and nervous excitement, strongly disposes them to inflammation from other causes; and, secondly, that the same over-exercise, if continued too long, may exhaust at length the excitability of the organs, and thus impairing their powers, may expose the system to all the morbid consequences of a failure of their functions, as well as, generally, to the influence of morbific causes through the resulting debility.

CHAPTER III.

SYMPTOMATOLOGY, OR SEMEIOLOGY.

SYMPTOMS are those effects of disease which are either sensible to the patient, or perceptible by the observer. *Signs* are the evidences by which disease is made known. All symptoms are necessarily signs; but there may be signs which are not symptoms. Thus, the age or sex of the patient may serve to fix the character of some particular affection; and the cause of a disease, when known to us, often determines our opinion of its nature. These may, therefore, be signs; but they cannot be considered as symptoms.

Symptomatology, or Semeiology, is the science which treats of the symptoms and signs of disease, in all their relations. The course of a disease, so far as it can be observed, is the peculiar succession of its symptoms; the diagnosis is the application of the symptoms and signs to the formation of an opinion as to its nature; the prognosis is the deduction of inferences from the symptoms as to its future progress or result. The course of disease, therefore, its diagnosis, and prognosis, come within the province of symptomatology. It will be most convenient to treat first of the *symptoms* or *signs*; then of the *course*, which may be considered as including the *duration* and *terminations* of disease; next of the *diagnosis*, under which will be included the methods of exploring disease; and, lastly, of the *prognosis*.

SECTION I.

SYMPTOMS OR SIGNS OF DISEASE.

A division of symptoms has recently been made into those connected essentially with derangement of the vital properties, and those which consist in changes of the sensible properties of the system. The former have been variously denominated *general*, *rational*, and *vital* symptoms; the latter, *physical signs*. A little reflection will show that the distinction is not very philosophical. Many of the general, rational, or vital symptoms are appreciable by the senses. Thus, the cries of pain are heard; the derangements of the pulse are felt; and convulsive movements are seen. On the other hand, many of the signs called physical are clearly symptoms of some vital disturbance. Thus, the increased bulk of an organ, the modification of its healthy sounds, and alterations in its colour, are often immediate signs of changes in the vital actions. In these general remarks, therefore, I shall not follow the division alluded to; but, in the description of individual diseases, it will be most convenient, in many instances, to separate from the ordinary symptoms those signs which are elicited by certain processes of comparatively recent origin, as percussion and auscultation, and which have been distinguished by the designation of physical signs. Such a discrimination is called for by the considerations, that these latter require a peculiar training in the observer, in order to be fully appreciated, that they have not yet received the universal attention which they merit, and that, if treated of indiscriminately with those better known and understood, they might tend, with many, rather to confuse than to aid the diagnosis.

It would be quite out of place, in this preliminary essay, to treat of all the symptoms severally. In the account of each disease, those which belong to that disease must, of necessity, be referred to; and to describe them now would be to render repetition unavoidable. Indeed, many of the phenomena which, under certain circumstances, are symptoms of disease, under others, are themselves diseases, and must, therefore, be fully discussed in the department of special pathology. Our attention here must be directed more especially to those phenomena, which, being common to numerous diseases, require a general description in order to be fully understood, and of which a description now will spare the necessity of much repetition hereafter. It will be necessary, moreover, to explain the nature of certain symptoms, which, not entering into the category of diseases, might otherwise not receive the special notice which they merit. The reader, however, will understand that our notice is to be directed, in this part of the work, to the symptoms themselves; their relation with the several diseases which they indicate being left for future consideration. In the following remarks, I shall pursue the natural order of the functions, beginning with digestion.

1. SYMPTOMS BELONGING TO THE DIGESTIVE FUNCTION.—Perhaps the most important of these are the symptoms presented by the tongue, which are here described more fully, in consequence of the great number of diseases in which they afford valuable indications.

Tongue.—In drawing inferences from the condition of this organ, it is important to know whether the appearances it may present are the result of local disease in the mouth, or of the sympathies which connect it with other parts of the system. In general, there is little difficulty in coming to a correct conclusion upon this point; and it is only necessary that the attention should be directed towards it. The following remarks have reference only to the general indications offered by the tongue. This organ seems to have been designed as an index, to the eye as well as to the ear, of the state of the system; so numerous and diversified are the morbid affections which modify its healthy appearance. It not only participates in all general derangements of the whole system, serving as one of the surest guides to a correct judgment in relation to the degree, progress, and precise stage of the disease; but especially also sympathizes with the different parts of the digestive tube, at one extremity of which it is placed.

The *bulk* of the tongue may be increased or diminished. Its enlargement, when not so considerable as to be very obvious, may often be known by the appearance of indentations on its sides, made by the pressure of the teeth. This is occasionally one of the first signs of the mercurial influence. Its contraction, when not the mere effect of dryness, is usually the result of a diminished supply of blood, and indicates either a general deficiency of the circulating fluid, or great feebleness of the heart's action. Like every other part naturally moist, it shrinks by drying; and, under such circumstances, no general inference can be deduced from its mere loss of volume.

Its *colour* is often greatly and significantly modified.' Morbid floridness of the tongue is the consequence either of the condition of the blood, or of its greater abundance in the organ. In the former case, an unduly arterialised state of the mass of the blood is indicated; in the latter, either over-excitement of the circulation generally, or phlogosis of the stomach. Redness of the tongue, not the result of local causes exclusively, has been supposed by some pathologists to be an almost certain sign of gastric inflammation or irritation. But this is far from being the case. It is often seen when no evidence of gastritis is presented, either by the symptoms or upon dissection, and is not unfrequently absent when that disease exists. Serious practical injury may result from this error. The red tongue can be considered as having special reference to the stomach, only when other symptoms point in the same direction; and, even then, is by no means a certain sign. A *livid* or *purple* colour of the tongue is usually dependent upon an insufficient aëration of the blood, and is a valuable sign, in connexion with the same colour of the lips. Not unfrequently the tongue is morbidly *pale;* and this state is a sign of deficiency of the blood in general, or of its red corpuscles in particular, or of great prostration of the circulating forces.

Its condition as to *dryness* and *moisture*, is often highly significant. But caution is necessary not to mistake dryness, from temporary and unimportant causes, for that which results from general disease. In persons who sleep habitually with their mouths open, the tongue is apt to be dry in the morning; and the same cause often produces the same effect in sickness. On visiting a patient, we find the tongue unexpectedly dry, and begin to feel some apprehension, until we learn that the patient has been breathing for some time through the mouth alone. A stoppage of the nostrils often gives rise to this phenomenon. In all doubtful cases, it is only necessary to request the patient to close his mouth, and then move the tongue about so as to moisten it. If he succeed satisfactorily, we may conclude that the dryness was accidental, and of no account. Another caution is requisite; to take care, namely, that a really dry tongue should not be mistaken for a moist one, in consequence of the patient having recently taken a liquid into his mouth. Dryness may exist in different degrees, from mere clamminess to perfect aridity. It depends on a deficiency of saliva, or of mucus, or both, and indicates a general tendency to diminished secretion. It not unfrequently occurs, as a sympathetic affection, in ulcerative inflammation of the small intestine. It affords sometimes the most important therapeutical indications, as will be fully shown hereafter. (See *Enteric Fever.*)

The *temperature* of the tongue serves as a guide to that of the body generally. When cold, it evinces, for the most part, great prostration of the powers of life. It proves that the process of calorification is failing at the very fountain; for the breath must be cool, before the tongue can become so in any considerable degree. This coldness of the tongue has been frequently noticed in severe cases of epidemic cholera. But we must take care not to confound coolness from local causes, as from ice in the mouth, or from the patient having slept long with the mouth open in a cold atmosphere, with that proceeding from the state of the system. Heat of the tongue, except when arising from inflammation of the organ, may be considered as a sign of a general elevation of temperature.

But the condition usually denominated a *furred tongue* is, perhaps, the most valuable diagnostic symptom afforded by that very important little member. In this state, the tongue is covered with a morbid coating, which adheres so firmly that it cannot be removed, without removing a portion of the surface along with it. Occasionally, deposits take place from the saliva and the mucus of the mouth; but these are easily removable, and must be distinguished from the genuine fur. The latter proceeds from a secretory process of the tongue itself, and seems to be incorporated with the superficial layer of epithelium. It is almost always confined to the upper surface, where the structure of the membrane is papillary. Though very generally a sign of disease, it is not always so Some persons have a furred tongue habitually, more especially upon rising in the morning; and, though in the greater number of these there is probably some chronic disorder of digestion, yet in others the health appears to be perfect.

A furred tongue almost always accompanies fever, and is one of the most decided characteristics of that affection. Indeed, when considerable in degree, and not dependent upon stomatitis of any kind, it may very generally be regarded as a febrile symptom. When the fur is *white, thickish, tolerably uniform*, and accompanied with moisture, it usually indicates an open, active state of fever, in which, though the obvious symptoms may possibly be violent, there is not apt to be any lurking mischief, nor any malignant tendency. When *short*, very *adhesive*, and *rather scanty*, permitting the redness of the tongue to appear through it, and attended with some disposition to dryness, it is often a sign of a protracted and obstinate form of fever, which is apt to assume a low, nervous, or typhoid form. A *yellowish hue* of the fur is usually indicative of bilious disorder, being produced either by the vomiting of bile, or, what is probably much more frequent, by direct secretion from the tongue, consequent upon deficient secretion by the liver, or an excessive production of bilious matter in the blood. Not unfrequently, this colour of the tongue is accompanied with a bitter taste. It is common in miasmatic fevers, and hepatic diseases. A *brown or black tongue* is usually indicative of a low state of the system, and an impaired condition of the blood. It is owing to the secretion of a dark matter, apparently identical with that which collects about the teeth and lips in typhous fevers, and probably consisting of blood modified in its passage out of the vessels. The same action would seem to take place in the tongue as that which, in the stomach and bowels, occasions the black discharges so common in malignant fevers. It may depend on an enfeebled state of the secreting tissue, or a diseased state of the blood, or on both united. Very frequently, this darkness of the tongue supervenes upon a previously white coating, and indicates a deteriorated state of the vital forces and probably of the blood. The caution should be observed, not to confound this discoloration with that which may proceed from accidental causes, as from the chewing of liquorice, tobacco, burnt coffee grains, &c. In many instances, the white fur of the tongue is modified by *red points*, which are the tops of the swollen and projecting papillæ. This appearance is not uncommon in eruptive febrile diseases, especially scarlet fever and measles. When consequent upon a dyspeptic state of the stomach, the fur is most copious in the morning before breakfast. In some persons, emptiness of the stomach is said always to induce this state of the tongue.

The manner in which a furred tongue becomes clean affords valuable indications. When the fur slowly recedes from the tip and edges, thinning gradually as it retires, it intimates a favourable convalescence. A portion of fur often lingers near the root of the tongue, long after the disease has given way. In another mode of cleaning, the fur loosens and separates in flakes, often beginning at the middle or near the root, sometimes in large patches, or over almost the whole tongue at once, leaving a smooth, red, glossy surface, as though the papillary structure had been lost. In such cases, if acute, and if the tongue remains moist, convalescence almost always takes place, though usually tedious, and sometimes very lingering. In threatening fevers, it is very desirable to witness this phenomenon; and, as it is often preceded by a feeling of soreness in the fauces, this may be considered, when it occurs in such cases, as an auspicious circumstance. Much stress was laid upon this as a prognostic symptom by the late Dr. Joseph Parrish, of Philadelphia. Sometimes the fur recurs once and again, before it ultimately disappears; and weeks and even months are occasionally consumed, in the struggling and apparently uncertain advance of the system towards health. In less favourable cases, the tongue, after having commenced the process of cleaning, as just described, or even after completing it, instead of continuing moist, becomes as dry as a chip, with an aggravation of all the symptoms, and no little increase of danger. The indication is still more unfavourable, when, in addition to its dryness, the surface becomes gashed, chapped, or fissured, or exhibits a rough, scaly appearance.

This smooth, red, and glossy state of the tongue, sometimes with moisture and sometimes with dryness, is not uncommon in chronic diseases, in which it is generally a bad sign, and is supposed to indicate serious organic derangement of the alimentary mucous membrane. A still worse condition, however, is an aphthous state of the tongue, which is apt to come on in the advanced stages of chronic diseases, and is generally to be received, under these circumstances, as a fatal sign, though of itself, and occurring in ordinary health, it is in no degree alarming.

A *loss* or *depravation* of *taste* is not uncommon, and is generally of little consequence, depending upon a mere derangement of the surface which receives the gustatory impressions. But, when of a paralytic nature, it is much more serious, as it generally indicates disease within the encephalon.

The only other point requiring consideration refers to the *movements* of the tongue. When, in acute febrile diseases, these are not under the control of the patient; when, upon being requested to protrude the tongue, he is unable to do so, or when the organ trembles much in the attempt, the symptom is exceedingly unfavourable, indicating either great prostration, or dangerous cerebral disease. Of similar unfavourable prognostication, under the same circumstances, is the occurrence of a difficult and hesitating utterance, like stammering. The inclination of the tongue towards one side, when protruded, usually indicates palsy, and is one of the common attendants upon hemiplegia.

Deglutition.—This is occasionally difficult, or impossible. The causes are, 1. inability of the muscles concerned in the process to contract properly, either from a general prostration or derangement of the nervous power, from paralysis, or from inflammation of the muscles themselves or the neighbouring parts; 2. contraction of the passage by stricture, or tumours compressing it from without; 3. too great bulk in the body to be swallowed; and 4. disease of the larynx, preventing an accurate closure of the glottis, and consequently admitting the food or drink to enter that aperture upon every attempt to swallow, as when the epiglottis is ulcerated, or swollen and stiffened by inflammation. From this view of the causes of difficult deglutition, it is obvious that the symptom is of considerable importance, and that care is requisite not to misinterpret it. When the consequence of pure functional nervous disorder, as sometimes happens in hysteria, it is of little account; but, when arising from the other causes mentioned, it often affords just ground for great solicitude.

Appetite and Desire for Drink.—The appetite for food may become excessive, deficient, or depraved. The temporary loss of it is one of the most common results of disease, especially of fever, and its return one of the surest evidences of convalescence. So much is this the case, that hunger, during the existence of fever, is considered a bad sign, indicating great derangement of the nervous system. It does not necessarily follow, from the loss of appetite, that the stomach must be diseased. The sense of hunger, though referred to the stomach, and often undoubtedly originating in that organ, is probably, in general, the result of impressions conveyed to the sensorium from all parts of the system, and arising from the consumption of the organized tissues everywhere, in the performance of the various vital functions. In disease, these processes may cease, and the sense of hunger must cease along with them. Food would, under these circumstances, burthen the system, and is, therefore, not called for. This is one and probably the most frequent cause of loss of appetite. It may result also from derangement of stomach, without any disease whatever elsewhere. Excess of appetite, or *boulimia*, as the affection is technically denominated, is much less common than its deficiency. It may arise from a certain amount of irritation of stomach, from excessive consumption of the living tissues or of the blood, or from mere nervous derangement. Hence its occurrence in certain forms of dyspepsia, in diabetes, and hysteria. Depraved appetite, or a desire for substances ordinarily disgusting, or wholly unfit for nutrition, is an occasional result of gastric disease, or of affections in which the nerves are deranged, as in hysteria or pregnancy. It is, however, a rare symptom.

The desire for drink is morbidly excessive, even more frequently than the opposite state of the appetite for food. It is, moreover, very often in excess in those very cases in which the desire for food is lost, as in febrile diseases generally. But *thirst* may arise from two very opposite conditions, which it is important not to confound; one, a condition of excitement, and the other of depression. Like hunger, the sensation of thirst probably arises from impressions transmitted to the sensorium from all parts of the frame, wherever the blood circulates. That it is referred to the fauces, is no proof whatever that it originates there exclusively. Whenever the blood is in a state requiring dilution, an impression is received from it by all the tissues which it supplies, which impression, conveyed by the nerves to the brain, occasions the feeling of thirst. Hence, this sensation is experienced when the blood is hot and stimulating, as in fevers and inflammations; and when it has become too much diminished by hemorrhage, or by excessive secretion or exhalation, as in cholera, colliquative sweats, diabetes, &c. Every one is familiar with the thirst of fever. That of the opposite condition of exhaustion is no less urgent. It is highly important that the distinction should be borne in mind; and that the mere existence of thirst should never be considered as a sufficient evidence of sanguineous congestion or excitement. Extreme thirst sometimes attends the lowest states of prostration in malignant diseases. The most pressing want, in some cases of this kind, is of cold water. This has been considered as a sign that the blood is congested in the interior organs, and that depletion is requisite. It is, in fact, only a sign that the capillaries are everywhere nearly empty, and are making an urgent call, through the sensorium, for liquid to fill them.

Nausea and Vomiting.—These, together with various other derangements of stomach, will receive special notice hereafter. Reference is here made to them only to observe that, when nausea and vomiting are very obstinate, without any obvious cause, without, for example, any apparent disease of the stomach or other abdominal viscus, and without spinal tenderness, there is reason to fear that either an eruptive affection is maturing itself, or that the brain is diseased.

Defecation.—In relation to the symptoms afforded by this process, it is only necessary here to allude to their great importance, and to urge upon the student the necessity of attending to them. This is the more necessary, as they are often overlooked. The patient states that his bowels are regular, and the physician is satisfied with the information. But it very often happens that a most erroneous impression is conveyed. The patient, it is true, may have had an evacuation daily; but it may have been scanty, and quite insufficient to prevent large fecal accumulation. Instances even occur, in which there is apparent diarrhœa, but real and dangerous constipation. The physician, therefore, should always assure himself of the true state of the case. But the existence, or non-existence of constipation is not all that is to be attended to. The colour of the stools, their consistence, and nature, are often most important guides to the discovery of disease. The habit, therefore, of inspecting the evacuations of the sick, however disagreeable it may be, is indispensable to a proper performance of the duties of the physician. A false delicacy may, under other circumstances, lead only to inconvenience; in our profession, it is but too frequently fatal.

2. SYMPTOMS BELONGING TO THE RESPIRATORY FUNCTION.—The absorbent system offers no symptoms which merit notice in this place. The same, however, cannot be said of the respiratory system. The symptoms presented by the latter are of the highest importance, as signs not only of diseases of the lungs, but of various other organs, and even of the system generally. Thus, respiration may be abnormally *frequent* or *slow*, *rapid* or *prolonged*, *forcible* or *feeble*; it may be *irregular*, *wheezing*, *stertorous*, *spasmodic*, or *convulsive*; it may also be peculiar in the association or succession of its movements, or by attendant phenomena, as in *sneezing*, *coughing*, *laughing*, *crying*, *sobbing*, *sighing*, *yawning*, and *hiccough*. The *temperature* and *odour* of the expired air may become signs of disease. The breath is hot in fevers, and cool in certain diseases of great prostration, as in the collapse of cholera, and the last stage of malignant typhus. A sour smell of the breath indicates acid in the circulation; an offensive smell, either gangrene of the lungs, a diseased state of the blood, mercurial action, or local diseases in the mouth, fauces, or nostrils. By its peculiar odour, poisonous substances which have been swallowed, can sometimes be detected, as alcohol, and prussic acid. The *matter of expectoration* affords other and most valuable signs. The various physical signs made evident by measurement, percussion, auscultation, &c., are of incalculable importance. Most of these, however, will be sufficiently considered under diseases of the respiratory organs. At present I shall only offer some observations upon dyspnœa and cough.

Dyspnœa.—This literally signifies difficult breathing. The term may be so extended as to embrace all cases of increased frequency or force of respiration, attended with obvious effort, and all others in which the sensations of the patient are painful, whether there be augmented movement or not. A patient may be unconscious of a disturbance which is very obvious to others, and very painfully conscious of a difficulty which others do not see. The affection, in both cases, is here ranked with dyspnœa. It is a very frequent symptom, dependent on very different pathological conditions, and offering the most opposite practical indications. In all its varieties, however, there must be one thing constant; and that is, an impression of a peculiar kind upon the nervous centre which presides over respiration. This may be transmitted to the centre from the various parts interested in the results of the function, or it may be the consequence of disordered action originating in the centre itself. In its higher grades, it constitutes or rather occasions, the sensation of *want of breath;* and, in all cases in which the efferent nerves are not defective, or the respiratory muscles paralyzed, it gives rise to movements more or less excited of the organs of breathing. The remote cause of dyspnœa is usually a want of the due arterialization of the blood. From all parts of the system where this want is experienced, and especially, it is probable, from the pulmonary air-cells and bronchia, there goes up, through the afferent nerves, to the medulla oblongata, an impression, which occasions the feeling of want of breath, and causes to be transmitted from that centre, through the efferent nerves, a motor impulse to the respiratory muscles. According to the degree of the want, is the strength of the sensation, and the energy of the consequent movements. In bad cases, the distress of the patient for want of breath is extreme; he gasps for air, his chest heaves laboriously, he is compelled to maintain the erect position, he cannot bear the windows or doors shut even in cold weather, and sometimes leans out of a window, as if in search of breath. The necessity of maintaining the erect position, called *orthopnœa*, is owing to the greater freedom in the expansion of the chest in this position, and the relief it affords from the pressure of the abdominal viscera, in the horizontal posture, upon the diaphragm. In the mildest cases, there may be only a slight feeling of uneasiness, or no uneasiness at all; and the only apparent morbid result is an increase in the frequency of respiration, of which the patient himself may not be sensible. Between these two extremes there is every grade.

Should the efferent nerves, or the muscles of respiration be paralyzed, then the patient may experience the greatest conceivable anxiety and oppression, amounting to a sense of suffocation, without any or with little violence of respiratory movement. Again, should the nervous centre lose its susceptibility under the influence of badly aërated blood, as not unfrequently happens, there may be neither sensation nor increased movement; and asphyxia, or a state approaching to it, is produced. It may happen, moreover, that irritation may exist in the nervous centre, independently of any deficiency in the aëration of the blood, as in nervous disease, and especially in hysteria; and this irritation, transmitted to the muscles of the chest, may produce hurried breathing or dyspnœa.

The circumstances under which the main condition requisite to dyspnœa, the want of due aëration of the blood, may occur, are very diversified. Thus, the blood may be in a state of disorganization from malignant disease, in which it is unable to undergo the requisite changes in the lungs; though, in such cases, the nervous centre is also apt to become unimpressible, and respiration languishes or ceases, instead of being excited. Another condition is that in which the blood, from various causes, becomes congested in the pulmonary capillaries, so as to impede the entrance of air into the cells, and at the same time retard the pulmonary circulation. A third condition is afforded by different diseases of the lungs, which produce consolidation, compression, or destruction of the pulmonary tissue, or fill the cells with liquid, so as to exclude the air. Inflammation of the lungs, bronchitis, pulmonary hemorrhage, pleuritic effusion, dropsy of the chest and pericardium, tumours of all kinds within the chest, pulmonary consumption, &c., operate, in excluding the air from portions of the lungs, in one of the modes just mentioned. The portion to which the air has access is insufficient properly to arterialize the blood; the condition requisite to dyspnœa is produced; and respiration is augmented, in order that the sound portion of the lungs may, by performing additional duty, counterbalance the loss of function in the diseased part. A fourth condition consists in the constricting of the air passages by spasm, tumours, &c., so as to impede the free access of air to the cells. An example of this is presented in spasmodic asthma. A fifth condition is that of disease of certain muscles of respiration, either paralytic, rheumatic, or inflammatory, in which they become unable to contract, and thus throw their duty upon the other muscles, which are stimulated to excessive action. Thus, when the diaphragm cannot descend, the ribs move much more in respiration than under ordinary circumstances. Lastly, the fault may be in the air, which may be too much rarefied, or its place supplied by irrespirable gases, so that the blood cannot become duly aërated. From this sketch it will be seen, how various are the circumstances under which dyspnœa may be produced, and yet how important to discriminate between them, as they often require peculiar plans of management. It is usually severest in acute diseases, in which the cause is sudden, and the sensibility of the nervous respiratory centres is yet unimpaired.

Cough.—This is the sound produced by a sudden and forcible expiration, preceded by a temporary closure or resistance of the rima glottidis, in order to give additional impulse to the current of air. It is generally succeeded by a fuller than ordinary inspiration, in consequence of the exhaustion of the air in the lungs by the previous act. Occasionally, the rima glottidis is made tense during the inspiration, in which case, this also is attended with sound, as in hooping-cough. Cough, like dyspnœa, depends upon an impression received by the nervous centre, producing a sensation of tickling, pressure, fulness, or other uneasiness in the respiratory passages, especially the larynx and trachea, which then causes the transmission of motor influence from the centre to the muscles concerned. The object aimed at in the process, is obviously the removal of matters in the air-tubes, which might interfere with respiration.

The source of the impression made upon the sensorium is various. Most frequently, it is some irritation of the respiratory mucous membrane, either consequent upon the presence of foreign bodies, such as dust, acrid vapours, &c., admitted with the air, upon certain qualities of the air itself, as coldness and dampness, which operate by reaction, or upon substances extravasated into the passages, as mucus, pus, blood, &c. Inflammation, from whatever cause, acts as a source of uneasiness, both by producing effusion, and by exalting the sensibility of the membrane, whereby the ordinary healthful stimuli are converted into irritants; the air itself being sometimes sufficient, under these circumstances, to excite cough. Certain parts of the air-tubes are much more susceptible to this irritation than others. The glottis is especially sensitive, with the purpose, no doubt, of guarding the entrance of the tube against injurious agents. Another source of the sensorial impression above alluded to, is some disturbance conducted by the afferent nerves of respiration, from parts not directly connected with the air-tubes, as the parenchyma of the lungs, the pleuræ, the pericardium, the stomach, the liver, the bowels, the peritoneum, &c. It is probably through branches of the par vagum, directly or indirectly, that impressions from these sources are conveyed to the medulla oblongata, and the brain. A third source of the impression is some inappreciable change in the nervous centre, or the respiratory nerves entering it, such as occurs in hysteria, and sometimes in gouty or rheumatic individuals, producing nervous and spasmodic coughs, without any apparent disease of the thoracic or abdominal viscera.

There is great diversity in the character of the cough, which has received names corresponding with its peculiarities. Thus, we have the *dry cough* without, and the *moist cough* with expectoration; the *short, hacking cough*, resulting from slight irritation, and the *violent, spasmodic,* and *convulsive* *cough*, from high degrees, or peculiar modifications, of the same cause; the *occasional*, the *incessant*, and the *paroxysmal cough*, from the mode of recurrence; the *hoarse*, *wheezing*, *barking*, and *shrill* coughs, from modifications in the tension or capacity of the rima glottidis, or other portion of the respiratory tube; the *hollow cough* from its resonance in the enlarged bronchia, or pulmonary excavations; and finally, the *laryngeal* or *guttural*, the *pectoral*, the *hepatic*, the *stomachic*, the *verminous*, &c., according to the part from which it may be supposed to proceed, or the cause producing it.

Expectoration.—Expectoration is the act of discharging the secretions or fluids of the air-passages. This is usually effected by coughing. Sometimes, however, when the matter in the bronchia is very copious, it is thrown off in a full stream, by a simultaneous contraction of all the muscles of expiration, without any resistance whatever at the glottis. The process resembles vomiting, and it is sometimes difficult to determine whether the substances discharged have proceeded from the lungs, or from the stomach. Chomel calls it *pectoral vomiting*. It is in this manner that blood is sometimes expectorated in violent attacks of hæmoptysis. A third mode of expectoration is that in which the liquid rises up gradually, and without any effort on the part of the patient, as far as the glottis or fauces, when it is removed by hawking. The matters expectorated are called *sputa*. These will be treated of under the special diseases in which they are severally met with.

3. SYMPTOMS BELONGING TO THE CIRCULATORY FUNCTION.—The heart affords by its action, size, or position, numerous signs very important in diagnosis. These will be considered when we reach the diseases of that organ. Upon the pulse, it is necessary to make some preliminary observations, as that phenomenon is constantly referred to throughout the work, and should be early understood.

The Pulse.—The evidences of the pulse in disease are probably, on the whole, the most important that we can attain; but they are not without their fallacies, and much caution is often necessary to avoid wrong inferences. The pulse, in the ordinary acceptation of the term, is the beating of the arteries. In each pulsation, the vessel is slightly expanded, and sometimes laterally displaced, and then returns to its original size and position, after which there is an interval of rest. The influences concerned in its production and peculiarities, are those of the heart, the arteries themselves, and the blood. The heart gives the impulse by which the expanding wave of blood is carried onward; and the vessel contracts, either by its elasticity alone, or by some additional vital force. It is obvious that the frequency of the pulsations, and the regularity or irregularity of their succession, must depend upon the heart. The pulse at the wrist, when it can be felt, always corresponds with the systole of the ventricles, allowance being made for the very slight interval that must elapse, before the wave reaches so distant a part. To the heart's action must also be referred most of the other healthy characters of the pulse; and for the source of its peculiarities in disease, we must look chiefly to the same organ. But the state of the arteries is not without its influence. These vessels are gifted, like all other living and movable tissues, with a certain degree of vital contractility or tone, upon which their healthy firmness depends. Without this tone, they become relaxed and flaccid, yielding readily to the expanding force of the blood, and not rapidly recovering their dimensions when the impulse ceases. It is evident that, in this condition of the vessels, that portion of the heart's impulse which is employed in dilating the arteries, is not restored to the blood duly by the contraction of their coats, and is, therefore, partially lost before it reaches the extremities. Hence, the pulse, in such cases, is not a proper measure of the strength of the cardiac contraction. The latter may be strong, while the former is comparatively weak. Again, an excessive tension of the arterial coats may occasion a resistance to the finger, which might lead to improper inferences as to the force of the heart. Happily, however, there is a general correspondence between the arterial and cardiac pulsations, which renders the former, in the great majority of cases, a tolerably correct measure of the latter. The quantity of the blood also has undoubtedly some influence upon the character of the pulse. When it is in excess, the pulse is likely to be fuller than usual, when deficient, smaller. The rule, however, is not absolute. The pulse may be small, even in a plethoric state of the system, if some obstruction to the pulmonary circulation exist, causing congestion in the lungs and venous system, and preventing a due supply to the left ventricle. It is hardly probable that difference in the quality of the blood can act upon the pulse in any other way, than as it may affect the condition of the heart or the vascular coats. After this view of the causes of the pulse, it will be proper to give an account of its qualities. These may be included under the heads of frequency, quickness, mutual relation of the pulsations, volume, tension, strength, and subordinate movements.

Frequency of the pulse has relation to the number of pulsations in a given time. This varies considerably within the limits of health. It differs greatly with the age. The following has been generally considered about the average frequency in health, at different ages; *viz.* from 130 to 140 in a minute soon after birth, 100 to 120 in the second year, 90 in the eighth year, 80 at puberty, 65 to 75 in persons of middle age, and 55 to 65 in the old. But the numbers are given very differently by authors; and the most opposite assertions have been made upon the subject. Thus, according to M. Billard, the pulse of new-born infants is often as slow as that of adults; and MM. Leuret and Mitivié state, as the result of numerous observations, that the pulse of the old is more frequent than that of the young; the mean for the former being 73, and for the latter 65. Dr. Pennock, of Philadelphia, found the average pulse in 170 men, of the mean age of 64·09 years, to be 71·83 in the minute; and in 203 women, of the mean age of 70·57 years, to be 78·02. (*Am. Journ. of Med. Sci.*, N. S., xiv. 70.) Perhaps the pulse of the old has hitherto been thought slower than it really is; but, judging from my own observations, I am inclined to believe that the statement first made, with some allowance for too low an estimate in this respect, is not far from the truth; the individual being supposed to be sitting, when his pulse is counted. It is certain, however, that very many exceptions will be found; for there are few points in which men differ more, physiologically, than in the frequency of the pulse. Thus, young persons are occasionally met with having a pulse below 60; while in old men it is sometimes above 80; and constitutional idiosyncrasies have occurred, in which it has habitually exceeded 100, or fallen short of 30 or 40 without apparent disease.

Sex influences the frequency of the pulse. In women it is said, on the average, to be ten beats in the minute more frequent than in men. There is certainly some difference; but this, I think, is beyond the reality. Temperament is not without effect. The pulse is usually more frequent in the nervous and sanguine, than in the bilious and phlegmatic. It is often more so in thin than in fat persons, and, as it is said, in those under, than in those over the middle size.

The frequency is usually greater in the morning than in the evening, after a full meal than before it, in the standing than in the sitting posture, and in the sitting than the lying. Exercise and mental excitement generally increase it, and in some persons greatly. The effect of posture referred to may be resolved into that of muscular exertion. Dr. R. B. Todd has observed that, in some instances of great debility of the heart, the rule of increased frequency in the erect position does not hold, and may even be reversed. (*Lond. Med. Gaz.*, March, 1851, p. 397.) In the inverted posture of the body, the frequency is diminished, probably from pressure on the brain. During sleep, the pulse is usually considerably slower than in the waking state. In health, whatever exercise of function calls for a consumption of blood, tends, when increased, to excite the heart, and consequently to augment the frequency of the pulse.

In all diseases of excitement, the tendency is to an increased frequency of pulse; but the converse of the proposition is not equally true. In diseases of depression and debility, the pulse is sometimes slower than natural; but very often it is more frequent. This generally arises from the existence of some source of irritation, in the midst of the depression or debility. Indeed, it often happens that debility is one cause of extreme frequency of pulse. A certain supply of blood is demanded by the functions, and the heart, being too feeble to act forcibly, is driven to excessive frequency of contraction in order to compensate for its want of strength. It is obvious that an irritant, under these circumstances, must be felt more in the increased frequency, than the increased strength, of the pulse. Even profuse hemorrhage, and exhausting secretions, are often attended with frequency of pulse, especially upon the occasion of any muscular or mental effort.

Slowness of pulse is the general result of depressing causes, so long as no source of excitation exists in the system. Even with such a source, it will sometimes occur when the susceptibility of the heart has become exhausted; as towards the close of a fatal affection, and when the nervous centres, which are the medium through which stimulation reaches the heart, become insensible by disease, as in cerebritis and apoplexy.

It follows, from what has been said above, that little satisfactory inference can be drawn, as to the state of the system, from the mere frequency or slowness of the pulse, unconnected with its other qualities. It may, however, be admitted as generally true, that extreme frequency indicates irritation combined with debility.

Quickness of pulse is different from frequency. The latter has reference to the succession of the pulsations, the former to each one separately. A frequent pulse is one in which the number of beats is greater than usual in a given time; a quick pulse, one in which each beat occupies less than the usual time, though the whole number may not be increased. This quality of the pulse is owing to the mode in which the ventricle contracts, and almost always indicates irritation with little strength. The heart makes a quick, short, angry contraction, differing much from the somewhat prolonged and forcible contraction of real energy under excitement. The former is usually a sign of nervous disorder, the latter frequently of inflammation. The *jerking pulse* is a modification of that now under consideration. It is characterized by a quick, rather forcible beat, followed by an abrupt cessation, as if the direction of the current had suddenly changed. Dr. Hope considers this pulse as evincing deficiency of the aortic valves, and consequent regurgitation into the ventricle. Something like it may sometimes be observed in nervous affections.

The *mutual relation of the pulsations* may refer to their succession, their comparative duration, or their strength. In all these respects, the pulse is often irregular. It need scarcely be stated that the source of the irregularity is almost invariably in the heart. Occasionally, a pulsation is altogether omitted. This constitutes *intermission* of the pulse. The intermission may be regular, that is, may occur uniformly at the end of a certain number of pulsations; but much more frequently, it is irregular. But every intermission of the pulse at the wrist does not necessarily imply an intermission of the heart's action; for this may recur regularly, yet at times may be so feeble, that the impulse does not reach the extremities. Hence, intermissions of the pulse are sometimes observed, when the pulsations are regular over the heart. But very frequently, along with intermissions of the pulse, there is irregularity in other respects. Several beats may occur rapidly in succession, and then be followed by others at longer intervals; and these alternations are themselves frequently altogether irregular. A want of uniformity in the strength and duration of the several pulsations is also not unfrequent. One may be strong and another feeble, one quick, another prolonged; and often several run on successively of one character, to be followed by one or more of the other. Sometimes all the irregularities mentioned, or most of them, occur in the same pulse, which may then be called *hobbling*. Another, but comparatively rare incident, is the interpolation of an additional pulsation between two others, which occur at the regular interval.

The affections of the pulse above described are very common in diseases of the heart, and, though they often indicate nothing more than functional or mere nervous disorder of that organ, yet, when constant or very frequent, are sufficient to justify suspicion of something worse, and should lead to a close examination. Irregularity of pulse is sometimes observed in perfectly healthy individuals, who live to old age without any resulting inconvenience. This is especially the case with mere intermission, which is not uncommon in persons advanced in life. Habitual intermissions of the pulse, in elderly people, sometimes disappear during acute disease, and return when the disease is passed.

The *volume* of the pulse may be greater than usual, in which case it is said to be *full*, or it may be less than usual, when it is said to be *small* or *contracted*. Fulness of the pulse may depend on general plethora, on a prolonged and forcible contraction of the ventricle, to a certain extent on relaxation of the arterial coats, and on obstruction in the capillaries, without diminished power of the heart. It may be associated with strength, or with feebleness of pulsation. In the latter case, the pulse readily yields to the finger, and, in its extreme of debility, is sometimes called a *gaseous pulse*. It is not unfrequent in cases of watery or impoverished blood. A small pulse may result from general deficiency of blood, from congestion in the venous system or larger interior organs, from feeble action of the heart, from great tonicity of the arterial coats, or from certain constringing agents as cold and astringents. When very small, it is sometimes said to be *thread-like*. It may be associated, like fulness, with firmness or weakness. In the former case, the pulse is said to be *corded*. It often depends on the frequency of the heart's action, whether the pulse shall be large or small. Supposing the amount of blood circulated to be the same, the pulse will generally be small in proportion to its rapidity, and large in proportion to its slowness.

Tension is that property of the pulse by which it resists compression. It may be considered as generally synonymous with *hardness*. There is one condition, however, in which the pulse may be hard without being tense. I allude to instances in which the coats of the artery have become cartilaginous, or ossified. This often happens in the old, and the practitioner must be on his guard not to draw false inferences from it. True tension of the pulse requires a union of considerable strength of action in the heart with tonic contraction of the vascular coats. When very tense, and at the same time small, the pulse is sometimes called *wiry*. *Softness* of the pulse is synonymous with compressibility. It is usually indicative of general weakness, and, when connected with smallness, is often a sign of great prostration.

The *strength* of the pulse depends chiefly upon the force with which the ventricle contracts, but in some measure also upon the tonicity of the artery itself, and the volume of the blood. Into the idea of a strong pulse enter not only vigour of impulse, but a steady resistance to pressure, and a certain degree of fulness. We may have a sharp, forcible beat; but, if not sustained by a certain amount of subsequent firmness, we should consider the pulse as indicating rather irritation than real energy. A very contracted pulse, however tense, and however sharp the impulse, can scarcely be called a strong one. Force or momentum is, in the body as well as out of it, the product of velocity and mass. The more voluminous the pulse, the velocity being the same, the greater is its strength. Here then is a combination of all those conditions which indicate a general elevation of vital powers and actions; force in the heart's contractions, a high degree of general tonicity, and a large amount of blood. Hence, a strong pulse is rightly considered as a sign of a sthenic, or vigorous state of system. But it is not invariably so. Hypertrophy of the left ventricle may give strength to the pulse, even though the general powers may be failing. In some persons affected with that disease, the pulse remains strong almost to the very close of life. It is highly important, in judging of the condition of the system from the pulse, to bear in mind this effect of hypertrophy. *Weakness* is of course the opposite of strength of pulse. In this, the impulse is feeble, the tension is slight, and the volume often small. But, in cases of superabundance of an impoverished blood, or very slow action of the heart, or great relaxation of the arteries, or of all these conditions combined, there may be a full, and, at the same time, a feeble pulse. It is important not to confound this character with strength. The feeble pulse may be distinguished by the weakness of the impulse, and by readily yielding to slight pressure. As strength of pulse generally indicates vigour of system, so weakness indicates debility. But, as in the former case, so in this, there are exceptions to the general rule. The heart may from particular causes act feebly, while the energies of the system at large are unimpaired. Thus, violent pulmonary congestion, of an active character, may so far impede the passage of blood through the lungs that it cannot reach the heart in due quantity, and the pulse will be necessarily feeble. A mistake, in such a case, might be fatal. Inflammation, even of a vigorous character, in the nervous centres which more immediately influence the heart's actions, may so far reduce them as to give weakness to the pulse, and a semblance of weakness to the system. Inflammation of the substance of the heart may have the same effect. Excessive and continued nausea may, for a time, prostrate the circulatory forces, and produce the same phenomena; as in severe inflammation of the stomach or peritoneum. These are examples of depression of certain vital actions, but not of debility; depletion may be demanded instead of stimulation; and it is highly important that the young physician should enter upon the practice of his profession, properly guarded upon this point.

By the *subordinate movements* of the pulse, I mean modifications of the regular impulse, other than mere differences in force or duration. Besides the steady, onward motion of the volume of blood, there are often subordinate currents within the stream, which make themselves sensible by communicating a vibratory thrill to the coats. Hence the *thrilling* pulse of aneurism, diseased heart, and anæmia. The cause of this, as well as its indications, will be explained elsewhere. The *trembling pulse* is another modification. It probably depends upon successive efforts of the heart, in accomplishing one systole, and would indicate debility of the organ. The *rebounding pulse*, on the contrary, may be the result of an excess of energy, inducing a second and subordinate contraction of the ventricle, by which it may be more completely emptied than by the regular systole alone.

Some practical rules will close these remarks on the pulse. The physician should always bear in mind the possible individual varieties of the pulse, and make due allowances. Thus, in some persons the arteries are large, in others small; in some thin and distensible, in others thick and rigid; in some again superficial, in others, deep-seated. All these peculiarities have a decided influence on the apparent character of the pulse. Occasionally the arteries deviate from the usual course. This is not unfrequently the case with the radial artery near the wrist, where the pulse is usually examined. Instead of retaining its ordinary position in front of the wrist, it winds, in these cases, round upon the back; and there might sometimes be danger of supposing the patient to be pulseless. A still more probable source of error, is in those cases in which the artery winds around to the back of the wrist, but sends onward a very small branch, which occupies the ordinary position of the main vessel. I have known the pulse, under such circumstances, to be considered as evincing great debility.

Great caution should be observed, while examining the pulse of nervous, excitable, or timid persons, to do so quietly and without any display of hurry or eagerness. In individuals of this character, the heart is often excited to increased frequency of action by the slightest causes, and it is impossible, under such circumstances, to draw any correct inferences from the pulse. It is usually best to wait until the first agitation occasioned by the visit has subsided, before attempting to examine the pulse; and the physician may often very advantageously engage his patient in conversation, so as to divert the attention away from disturbing subjects of thought. The pulse cannot be relied on immediately after bodily exercise, or mental emotion of any kind. The patient should be in the sitting or lying position, unless it be desirable to ascertain especially the effect of standing.

It is best always, in a new case, to examine both wrists; as the artery of one side is sometimes larger than that of the other. Care should be taken that there be no pressure upon the artery in its course, as by the clothes in the axilla, by very tight sleeves, by tumours, &c. It is usually advisable to apply three or four fingers at once to the artery; as the larger the surface of contact, the more accurate is the impression received. The fingers should alternately press upon the artery, and relax the pressure, so as to appreciate its degree of resistance. Where great accuracy is required, it is best to count by a watch; and the physician will save time, and secure greater precision, by using an instrument with a second hand that makes four circuits in a minute. The pulse should generally be felt more than once at each visit. The physician thus becomes acquainted with its diversities, and will often have occasion to correct, if not reverse, upon the second examination, the conclusions he may have formed from the first. When the pulsations are excessively rapid, exceeding, for instance, 150 or 160, so as with difficulty to be enumerated, it may be proper, as suggested by Chomel, to count only as high as ten, and then to go over the same ground again, instead of advancing into the higher numbers, the longer names of which occupy more time in their mental repetition. Should the pulse at the wrist, from any cause, not answer the desired purpose, it may be examined in the arm, in the neck, or at the temples. By examining the pulse while the arm is much elevated, some inference may be drawn as to the strength of the heart's contractions, which must be very great to overcome the effect of gravitation, and sustain a full strong pulse at the wrist.

State of the Capillaries.—The state of the capillary circulation cannot always be correctly inferred from that of the circulation generally, and sometimes requires a distinct examination. By pressing the finger upon the skin, and observing the rapidity with which the blood returns into the whitened spot, we may ascertain the rate of the current through the capillaries. The colour also has much value as a symptom. When these vessels are sluggish, the skin is apt to assume a dark-red or purplish hue, which is sometimes very striking, and, when not dependent on the general condition of the blood, may be regarded, in connexion with the sign before mentioned, as a mark of debility. A florid colour, on the contrary, with a rapid movement of the blood, may be considered as an evidence of active excitement in these vessels. These signs are sometimes of considerable significance in cutaneous affections. It is occasionally important to be able to decide, whether redness upon the surface is the result of extravasation of blood, or simply of capillary injection. The test of pressure will generally determine this point. If the redness remain unaffected by the pressure, while the circulation is going on elsewhere, it may be referred to extravasation.

Venous Symptoms.—The only sign connected with the veins, which requires notice here, is the occasional occurrence of a venous pulse. This sometimes results from a continuation of the heart's impulse through the capillaries, and may generally, in this case, be considered as an evidence of high excitement of the circulation. In other instances, it is owing to a retrograde current, produced by the contraction of the right ventricle, and indicates an inaccurate closure of the tricuspid valve. This venous pulse is felt especially in the jugular.

State of the Blood.—This should always be examined when blood is drawn. From the characters which it offers to the eye, or to chemical or microscopical examination, important inferences may often be deduced as to the nature of the disease, and the previous diagnosis confirmed or corrected. Occasionally, too, affections which had before been lurking unseen are thus clearly revealed. The morbid states of the blood, however, and their indications are detailed elsewhere. The manner in which the blood issues from the opening is not without some value as a sign. An unusually forcible jet, and rapidity of flow, may be considered as evidences of energy in the circulatory movement; while the contrary inference may be drawn from an escape of the blood, drop by drop, when the opening into the vein is free, and there is no reason to suppose that any merely temporary interference with the action of the heart may be the cause of the phenomenon. In the latter case, it not unfrequently happens that the current gradually increases, and at last flows as vigorously as under ordinary circumstances. The symptoms presented by the blood must be observed incidentally; for it can seldom be proper to bleed for this purpose alone.

4. SYMPTOMS BELONGING TO THE FUNCTIONS OF NUTRITION AND SECRETION.—In relation to the symptoms connected with the former function, all that is necessary will be stated under special diseases. The most prominent of them are emaciation, softness and flaccidity of the tissues, and atrophy, indicating a deficiency of the process; obesity and hypertrophy indicating its excess, and various organic changes of tissue, indicating its perversion. The symptoms afforded by the secretions are often of the greatest importance, and should always be most carefully investigated. They consist in an increase, diminution, or perversion of the function. Sometimes there is a general deficiency of all the secretions, as in certain cases of fever; but a general increase is scarcely possible. Much more frequently, the deficiency, as well as the increase, is confined to one or a few organs. When the increase is so great as to be exhausting, the affection is called *colliquative.* Thus, we say *colliquative sweats*, *colliquative diarrhœa*, and *colliquative diuresis.* In perversion of the secretory function, the products are sometimes wholly different in character from those in health; being not unfrequently excessively irritant instead of bland, and sometimes yielding evidence to chemical reagents of the presence of new constituents. In some instances, one secretory organ seems to perform the office of another; as where the colouring matter of bile is thrown out by

the kidneys, when the liver ceases to secrete. The individual secretions which most require attention are those of the liver, the kidneys, and the skin. The symptoms connected with disordered hepatic secretion, are exhibited chiefly in the stools, which are deep-yellow, or clay-coloured, or dark, according as the secretion is too copious, deficient, or deranged. Those connected with the kidneys are seen in the excess, the diminution or suppression, and the alteration of the urine, which presents a great diversity of quality and composition, indicative of peculiar and very serious diseases. Independently of its variation in quantity, the perspiration also sometimes affords valuable signs by its quality, as when, by its sour smell, it indicates an excess of acid in the circulation, and by its offensiveness, an unhealthy state of the blood. All these symptoms, however, are fully noticed in connexion with the diseases they represent; and they are referred to here, only that the student may be impressed with the importance of making a close examination of them, in all serious cases.

5. SYMPTOMS BELONGING TO THE CALORIFIC FUNCTION.—Though the human system is capable of supporting great extremes of temperature, for a short time, with impunity, yet that of the body itself is never very greatly above or below the mean standard of health, until vitality has ceased, or has been so far reduced, as to have surrendered the body, in great measure, to the action of physical and chemical laws. The mean temperature of the body is about 100° F. Dr. Davy found the greatest deviation from this standard, in the cases of 114 individuals whom he examined, to be in the downward direction 96½°, and in the upward 102°. But in disease, especially in fevers, the heat of the body not unfrequently rises to 106°, and in a case of tetanus, mentioned by Dr. Edwards, was 110¾°; while in cholera it has been reduced to 66° in some rare cases, and 20° below the average has not been uncommon. It must be recollected, however, in estimating the temperature in disease, that in health it is higher in the young and vigorous than in the old, in the waking than in the sleeping state, near the heart than at the extremities, within the body than upon the surface, and that it may be somewhat elevated by active muscular exertion, and exposure to a high temperature. To determine accurately the heat of the body, it is necessary to employ the thermometer, the bulb of which should be placed under the tongue; but for all ordinary purposes the hand is sufficient.

It must be borne in mind that the temperature of the body, and the sensations of heat or cold felt by the patient, are very different things. Generally, they coincide in a greater or less degree; but not always. Sometimes the patient experiences chilly sensations when his surface feels hot to a bystander, as not unfrequently happens in the earlier stages of fever; and sometimes, on the other hand, he suffers greatly with a feeling of heat, when the surface of the body is really cold. These deranged sensations must be ascribed to nervous disorder. It is true that the heat, sometimes complained of by patients in malignant diseases when the skin is very cold, has been referred to sanguineous congestion of the internal organs; but the sense of heat is not confined to the interior, in these cases. I have known complaints to be made also of heat of the surface, under the same circumstances. It is, I have no doubt, a perverted sensation, consequent on the derangement of the nervous system, just as light flashes sometimes before the diseased eye in darkness, and roaring sounds are heard in the midst of profound silence. It is, moreover, for the most part, a very unfavourable symptom.

The change of temperature may be general or local; and it not unfrequently happens that one portion of the body is affected in one way, and another in another. Thus, the head is often hot, while the extremities are cold. Attempts have been made to designate, by particular names, different modifications of the sensations of heat and cold. Thus, we have the expressions on the one hand of chilliness, coldness, and rigors or shivering; and on the other of warmth, heat, burning, acrid heat, pungent or biting heat (*calor mordicans*), &c. The shivering, trembling, and shaking which often attend the feeling and reality of cold, sometimes occur as mere nervous phenomena, without reference to the existing temperature of the body.

6. SYMPTOMS BELONGING TO THE SENSORIAL FUNCTIONS.—These are exceedingly numerous. They embrace all derangements, not only of general and special sensation, as these terms are usually understood, but also of those feelings which proceed from the interior organs and tissues, and by which they make their wants and their sufferings known, such as nausea, hunger, thirst, breathlessness, &c. But these have already been considered, or will be considered hereafter, in connexion with the derangements of which they are the expressions. Our attention will at present be confined to the symptoms afforded by derangements of general sensation, and of the several special senses of sight, hearing, &c. General sensation is deranged in two ways. Either it is, in the first place, defective or altogether wanting, or, secondly, it is disagreeably altered, constituting various kinds of uneasiness, which, for convenience sake, may all be classed together under the head of pain. It is only the latter that requires any general remarks.

Pain.—This feeling is quite undefinable, and can be known only by those who have felt it. There can be no doubt that it resides exclusively in the nervous structure. It has various sources. Irritation or excessive excitement of the nervous function may produce it, either with our without vascular disease. It is a very frequent attendant upon inflammation, and is ascribed by writers generally to the pressure made upon the nerves in this affection. But, as it very often precedes the inflammation, appearing to be the first obvious step in that process, and as a much greater amount of pressure upon the healthy nerves does not produce it, the probability is, that it is the direct result of the irritant cause acting on the nerves. But there appears also to be a modification of the nerves, in which their sensibility is exalted, independently of any irritant agent, and in which pain is produced by ordinary agents which, in the healthy condition of the nerves, excite no sensation. It is possible, however, that this may be nothing more than an excitement, which, insufficient of itself to occasion uneasiness, may amount to pain when very slightly increased. Still, there are cases, and those by no means unfrequent, in which pain is attended with no appreciable excitement of any kind, whether nervous or vascular; but, on the contrary, occurs in a state of positive depression and debility, and even seems to be favoured by that state. Thus, a limb benumbed by cold, in which special sensation is almost lost, and vascular action is greatly diminished, often experiences exquisite pain; palsy is not unfrequently attended with the same symptom; and neuralgia is a common result of general debility. It is, therefore, a great error to consider pain as always an evidence of inflammation. It is, indeed, in very many instances, most effectually relieved by means calculated most strongly to aggravate the latter affection. Nor is inflammation always attended with pain. There is reason to believe that pain is seated in nerves, wholly distinct from those devoted to the special sense of touch. Hence the sensation of pain in parts benumbed by cold; and hence, too, the complete insensibility to painful impressions in some instances of somnambulism, or the mesmeric state, as it is called, in which the sense of touch, and the other special senses, are acutely alive to impressions.

Pain differs exceedingly in its modes of recurrence, degree, and character. Thus, it is fugitive or persistent, wandering or fixed, intermittent, remittent, or continued. In its different grades, it is slight, moderate, severe, violent, intense, excruciating, or agonizing. In character, it is *dull* or *obtuse*, *sharp* or *acute*, *aching*, *smarting*, &c.; and, in its different varieties, has received peculiar names from certain real or supposed analogies, as *lancinating*, *cutting*, *stinging*, *pungent*, *boring*, *tearing* or *rending*, *gnawing*, &c. When attended with a beating sensation, consequent upon the heart's action, it is called *pulsating* or *throbbing*; when with a feeling of tightness, *tensive*; when with weight, *heavy*; when with heat, *burning*. There are also peculiar sensations, which, in excess, become positively painful, though they might not be considered so in their slighter degrees. Such are *itching*, *tickling*, *prickling*, *tingling*, &c. To pain belongs also *tenderness*, or that property by which a part becomes positively, and sometimes acutely painful, by motion or pressure. Tenderness is considered by some as one of the most certain signs of inflammation. But, though it very commonly accompanies that process, it often exists without it. Thus, it not unfrequently attends neuralgia, and generally follows severe spasm, whether in the exterior muscles, or in the muscular coat of the stomach and bowels. This fact is of some practical importance; as the knowledge of it may spare many a patient an unnecessary and perhaps injurious loss of blood. Under pain, finally, we may rank those general and indefinite sensations which are vaguely designated by the terms *general uneasiness*, *restlessness* or *inquietude*, *anxiety*, and *oppression*; sensations which indicate disorder of the nervous system, and are often useful as signs.

It has been stated above that pain is sometimes wandering, and sometimes fixed. Wandering or flying pains are frequently purely nervous or neuralgic, and fixed pains inflammatory; but the distinction is by no means constant. This character, however, may often be employed as a diagnostic symptom. Thus, it may be doubted whether a pain in the side is symptomatic of pleuritis or pleurodynia. If fixed, the presumption is that it is the former; if wandering from one point to another, that it is the latter.

Pain is different in the different tissues. In the serous and synovial membranes, it is often severe, and sharp or acute; in the mucous membranes and parenchyma of the viscera, dull or obtuse, oppressive, heavy, &c.; in the skin, it is apt to be burning, itching, tingling, &c.

It is not always that pain is felt in the spot where the cause of it exists. Thus, in irritation of stomach, it is often referred to the forehead and eyes; in hepatitis, to the shoulder; in inflamed hip-joint, to the knee; and in disease along the course of any passage, to the outer extremity of the passage, as in the case of stone in the bladder, in which the pain is often felt at the end of the penis.

In judging of the degree of pain in any particular case, we must not always be determined by the statements of the patient. Very different meanings are often attached to the same words by different individuals; and some have the habit of using terms of exaggeration for all their feelings. In such cases, we must be guided more by the expression of the countenance, and the tone of the voice, than by what is said. If a person tell us, with perfectly composed features, and a calm equable tone of voice, that he is suffering excruciating pain, we shall be justified in estimating its severity greatly below the real value of the term.

Patients also have very different degrees of sensibility, and feel with different degrees of acuteness. Some persons are little sensitive to painful impressions of any kind, others suffer really and greatly from slight causes. External cancer, which, in most individuals, is a source of extreme suffering, appears in some scarcely to produce pain.

Special Sensation.—The several senses, sight, hearing, smell, taste, and touch, are liable, like all other functions of the body, to be morbidly exalted, depressed, or perverted. They are very apt to be deranged, not only by direct morbific impressions, but also by irritating impressions proceeding from distant organs, and reflected upon them from their respective nervous centres. Hence the *muscæ volitantes*, and the *tinnitus aurium*, which so frequently accompany derangement of stomach. But the symptoms connected with the senses, will be most advantageously treated of with the diseases of the organs of the senses respectively.

7. SYMPTOMS BELONGING TO THE INTELLECTUAL AND EMOTIONAL FUNCTIONS.—These are very numerous, embracing all the phenomena of deranged intellect, defective, augmented, or perverted memory, emotional excitement, whether pleasing or painful, depression of spirits, depraved dispositions and tastes, and every variety of facial expression. Those forms of diminished, suspended, or disordered cerebral action, denominated heaviness, drowsiness, somnolence, stupor, lethargy, coma, vertigo, giddiness, dizziness, faintness, wakefulness, disturbed dreams, somnambulism, &c., may all be included in the same category. All the general remarks that are necessary may be arranged under the two heads of delirium and facial expression. It may, however, be proper to state that some diseases have a remarkable tendency to produce cheerfulness, confidence, or resignation of spirit, as phthisis; while others evince an equally strong tendency to mental dejection and despondency, especially the gastric and hepatic affections.

Delirium.—This is an acute and temporary disorder of the intellectual or perceptive faculties. When chronic, it becomes insanity. It occurs much more readily in some persons than in others, under apparently the same circumstances. There are individuals who become delirious with the slightest fever; while there are others who scarcely ever evince signs of mental aberration, in the severest forms of febrile disease. The affection is more frequent in the young than the old, and in nervous persons than in those of a different temperament. It arises from different causes, producing the opposite conditions of irritation or depression of the cerebral functions, and especially from causes acting on the hemispheres. Those affecting the base of the brain are more apt to evince themselves by derangements of general sensation, or of the motive power. Meningeal affections are usually marked by delirium of the more active character, because the influence they extend into the cortical substance is sufficient to occasion irritation, without abolishing function; while original disease of the brain itself is apt to produce the latter effect, evinced, according to its degree, by impaired intellect, lethargy, coma, &c. Very frequently, the impressions which ascend to the brain from diseased organs in various parts of the body, especially the stomach, bowels, liver, and uterus, are sufficient to occasion delirium; and this is a more frequent effect of such causes than the abolition of function, because their effects are generally those of mere irritation, and stop short of organic disease. A want of due energy or action in the brain may be the occasion of delirium, as well as its excess. This is usually the result either of the withdrawal of some wonted stimulus, as in delirium tremens; of the languor which follows excessive excitement, as in the advanced stage of active delirium; or of the direct action of a sedative agent, as the poison of typhus fever, or the depraved blood of that disease and of the last stages of cardiac and pectoral affections. Organic cerebral disease may produce one or the other condition of function, according to its degree and extent. If moderate, or in the early stage, it may exaggerate the function, especially of those parts not directly involved in the disease; if extensive, or in the advanced stage, it tends rather to impair power and function together.

Delirium may, therefore, be active or passive. The active differs greatly in degree, being sometimes very *mild*, sometimes *violent*, or *furious*, and of all intervening grades. The milder grades are usually evinced by some mental aberration, with little disposition to action; the higher grades by superadded violence of gesture, voice, and language. In the passive delirium, the brain acts wrongly, because it cannot elevate itself to the point for the due perception of impressions, or the formation of judgments. Of this kind is the *low muttering delirium* of typhus. It often happens, in passive delirium, that an increase of the proper stimulus restores temporary correctness of thought. Thus, though the patient may be muttering sentences without apparent meaning; yet, if roused, and spoken to in a loud and distinct voice, he will often answer coherently and correctly.

Sometimes in delirium, there is a complete derangement of mind. The patient recognizes neither the persons nor the things around him. He is very apt to imagine himself in a strange place, and to insist upon returning home. This is often a bad sign. In other instances, the sensations and perceptions are correct, but the judgment is perverted. In others, again, only the perceptions are wrong, while the mind acts rightly upon the perception which it forms. Thus, the patient sees objects and hears sounds which do not exist, and acts as if those sights and sounds were real. When the fallacy of the perceptions or sensations is recognized by the patient himself, he cannot be said to be delirious.

Facial Expression.—This is of the greatest importance, and should be carefully studied by every practitioner. It is occasionally almost our sole dependence in diagnosis. Through it, we sometimes recognize the existence of pain, mental anxiety or depression, insanity, and even, in a general way, pectoral or abdominal disease, when other signs are either wanting, obscure, or not available. In the cases of children, of the insane, and of persons who may be disposed to deceive us, it is a peculiarly valuable resource. Many diseases are attended with a characteristic aspect of countenance, which will often be recognized by the experienced, so far at least as to suggest the disease to his mind. By a glance, we can often ascertain whether our patient has changed for the better or worse in our absence. But it is only by experience, and close observation, that this power is attained. The modifications and combinations of feature which constitute expression are too numerous, intricate, delicate, and evanescent, to admit of analysis, at least of profitable description.

There are, however, certain changes in the face of a more tangible character, connected rather with the organic functions than the action of mind, which can be more accurately appreciated. The colour, shape, temperature, and various movements independent of expression, often yield important indications. Thus, a bright-red colour signifies one thing, a dark-red, purple, or violet colour another. In the former case, the blood is duly arterialized, and probably sent up vigorously into the head; in the latter, it is unduly carbonaceous, and probably detained in the head by some obstruction to its return. Paleness also has its significations, as of anæmia, debility, nausea, &c.; and there are different kinds of paleness having different meanings, as that of scrofula or phthisis, and that of cancer. Yellowness of face is well known to point to disease of the liver. The colour of the lips is peculiarly expressive, in its different tints of crimson, purple, and paleness. The features may be full, swollen, turgid; or they may be shrunk, contracted, fallen; in the former case indicating œdema, or congestion, active or passive; in the latter, exhaustion, prostration, general collapse, &c. The *Hippocratic face*, so named because described by Hippocrates, is often referred to by writers as marking the near approach of death. It is characterized by a general contraction of the features. The nose is pinched, the temples hollow, the eyes sunken, the ears cold and shrunk, the skin of the forehead tense, the lips parted and relaxed, and the colour of the face pale or livid. Coldness of the ears and tip of the nose occasionally indicates the approach or presence of a chill, when other symptoms are wanting or ambiguous; and, in infantile cases, coolness of the cheeks, nose, and ears, sometimes enables us to decide upon the existence of a degree of prostration requiring support, when we might be embarrassed without that sign. Certain positions or movements of the features are sometimes also highly expressive. Thus, alternate contraction and expansion of the alæ nasi frequently indicate dyspnœa; irregular motions of the eyes, with contracted or expanded pupil, disease of the brain; and a falling of the under jaw, the last agony.

8. SYMPTOMS BELONGING TO THE MOTOR FUNCTION.—These arise from a deficiency or complete want of muscular contraction, as in debility, palsy, or local disease of the muscles; from an excess of contraction, as in spasm, convulsions, and subsultus tendinum; or from irregular or perverted contraction, in which the muscles act under the will, but not to the end proposed, as in chorea. Under this head are included all the voluntary motions; the gestures, the manner of walking, running, &c.; the positions, as standing, sitting, and lying; and all the symptoms connected with the voice, and speech, as suppression of voice, hoarseness, shrillness, dumbness, stammering, &c.

But these symptoms, and many others belonging to the different functions not here noticed, will be most advantageously studied in connexion with the several diseases in which they are found. Our limits do not permit of ampler details in this part of the work.

SECTION II.

COURSE, DURATION, AND TERMINATION OF DISEASE.

By the *course* of disease is meant the succession of its symptoms, in relation both to order and rapidity. When, from the commencement to the termination, the symptoms show no disposition to abate, or when they regularly increase in violence up to the point at which recovery begins, or the patient sinks, the disease is said to be *continued*. Neither of these events, however, often happens, unless in diseases of very brief duration. More commonly, the symptoms, after a shorter or longer continuance, abate considerably, without, however, entirely disappearing, and, having remained for a time in this state of relaxation, resume their original violence, again to abate as before; and this alternation of excitement and relaxation continues to the end. The disease, under these circumstances, is said to be *remittent*, the period of abatement is called the *remission*, and that of excitement the *exacerbation*. Frequently, all the symptoms yield entirely for a time, so as to leave regular intervals in which the patient is apparently free from disease. The complaint is then said to be *intermittent*, and the interval is called the *intermission;* while the stage of excitement is designated as the *paroxysm*.

The period at which the remission occurs may depend on the nature of the morbid condition, and, in that case, is peculiar in each disease; as on the third or fourth day in smallpox, and on the second and third day in yellow fever. It may also depend on causes unconnected with any particular disease, and existing either in the constitution of the frame, or in the influences to which it is subjected from without; and, under the operation of these causes, the remission occurs, in most diseases, at similar intervals, usually once in twenty-four hours. It is a law of our physical as well as moral nature, that excitement, even under the constant influence of stimulating agencies, cannot be long sustained at a particular point of elevation. We see this every day in health. The various agents, such as food, drink, heat, light, &c., which are necessary to sustain the system in its proper condition, may be present in an equal degree throughout a given period; yet the excitement produced by them flags after a time, and sleep, with a general reduction of the vital actions, occurs. So, under the influence of some morbid excitement, the action flags for a time, though the application of the excitement be continued. During this state of comparative rest or diminished excitement, the system acquires additional excitability, which renders it again susceptible to the influence of the stimulating agent; and the temporary reduction is, therefore, followed by a renewed elevation of the diseased process. It has been before observed that this change of remission and exacerbation usually takes place once in twenty-four hours. The cause of this is probably to be found in that habit of the system, acquired by the daily alternation of waking and sleeping. The excitability of the former condition being regularly diminished in the latter, a flux and reflux is established, which, in cases of disease, though it may occasionally vary in the precise point of accession or decline, is still, as a general rule, experienced within the habitual limits.

Upon the same principle, to a certain extent, may be explained the disposition observable in intermittent diseases to a daily return of the paroxysm. The cause of the disease gives rise to the first paroxysm at that period of the twenty-four hours, at which, in the advance or recession of the excitability, the system is in the most favourable condition for its action. The same condition is experienced about the same time on the following day, and the same result necessarily takes place, if the cause continue to operate. That the paroxysm should often occur every other day, and sometimes every third day, as in the tertian and quartan agues, must be referred to some unknown modification in the character of the cause, or in the properties of the system, which prevents the equilibrium of health from being disturbed on the first favourable occasion, and enables the vital resistance to triumph over the morbid influence, till, weakened by continued assault, it is compelled at last to give way.

Disease sometimes runs its course speedily, and sometimes is of long duration. In the former case, it is said to be *acute*, in the latter, *chronic*. These terms, however, are not definite. There are no characteristic signs which serve in every case to distinguish an acute from a chronic complaint; and the terms are not unfrequently employed to express different stages of the same affection; the disease being called acute in its earlier course, when the symptoms are most severe, and chronic, when its duration has become protracted, and its violence considerably abated.

There is another distinction between diseases, which is of considerable practical importance. Some appear to have no definite course, duration, or end; being more or less variable in the succession of their symptoms, lasting a less or greater length of time, and terminating favourably or otherwise, according to circumstances in the constitution of the patient, and in his relation to surrounding objects. Others, on the contrary, whatever may be the constitution, habits, or exposure of the patient, are disposed to pursue a certain course, and in a given time to end in recovery, unless fatal disorganization arrests their progress, or derangements of structure of a less violent character, resulting from the disturbance into which the system has been thrown, impede their march towards health. A third set of diseases are those which exhibit no tendency to a favourable issue, and which, if left to themselves, and sometimes in defiance of all treatment, go on gradually increasing in intensity till they ultimately destroy the patient. Examples of the first class are presented in rheumatic inflammation and neuralgia, of the second in smallpox and other exanthemata, and of the third in cancer. It is obvious that our treatment must be very much influenced by these differences in the tendencies of disease; being directed to the subversion of the morbid action, in cases which admit of a direct cure, and to the prevention, as far as possible, of dangerous consequences in those which run a fixed course; while, in those of an incurable nature, we must be content with endeavours to alleviate the sufferings and protract the life of the patient. It is particularly important that the practitioner should bear in mind the disposition of many, perhaps we might say of most diseases, to terminate favourably after having run a certain course, provided fatal organic injury can, in the mean time, be prevented. With this conviction ever present to his mind, he will be less disposed to waste his own efforts, and the vigour of the patient, in vain attempts to effect an immediate cure; and, even in cases in which the disease may possibly be arrested in its progress, will often prefer such moderate measures as will insure ultimate recovery, in the natural course of things, to the chance of more speedy success from violent remedies, with the risk of serious mischief.

Crisis.—The name of *crisis* is usually applied to the turning point of disease; the point at which it begins to give way, if its end is to be favourable, or to become decidedly worse, if unfavourable. This period is often attended with certain phenomena which mark the favourable or unfavourable change, and are, therefore, denominated *critical symptoms.* The most common of these are augmented secretions, hemorrhages, cutaneous eruptions, glandular swellings, and abscesses. The secretions are usually from the skin, bowels, and kidneys, constituting *critical sweats*, *critical diarrhœa*, and *critical diuresis.* At one time, great importance was attached to these discharges. It was supposed that they carried the peculiar peccant matter out of the system, thus proving positively curative; and any interference with them was strongly deprecated. Though this view of their influence is no longer entertained; yet they are still looked on by many as, in some instances, very useful, by removing irritation or congestion, or, when of an inflammatory character, by calling off diseased action from its seat, upon the principle of revulsion. In most cases of disease, however, there are no symptoms which can strictly be denominated critical; and, when they do occur, they may be considered, in general, as coming under one of the three following heads. They are either, *first*, regular results of the pre-existing morbid conditions, explicable upon ordinary pathological principles, as when the excited vessels of the skin in fever unload themselves by perspiration; or, *secondly*, transfers of disease from one organ to another, under various accidental influences, as when rheumatism ends in diarrhœa; or, *thirdly*, new diseases supervening upon those already existing, and superseding or increasing them, as the case may be, as when an attack of bleeding piles, occasioned by straining at stool, relieves an existing attack of splenitis or hepatitis.

Hippocrates believed that disease, in general, was more disposed to change at certains periods than at others; and he designated the 7th, 14th, 20th, 27th, 34th, and 40th days, as constituting the periods alluded to, which he named *critical days.* It will be perceived that the intervals between the days mentioned are very nearly a week; and Hippocrates considered the crisis as falling on the last day of each septenary period. He carried the doctrine further, and supposed that there were certain intermediate days, in which, though the tendency to change was not so strong as in those mentioned, yet that it existed in a certain degree; while there were others in which the disposition was still less, and others again in which a crisis never occurred. These notions of the father of medicine certainly do not apply, with any great accuracy, to diseases as they now exist; yet there appears to be some vague relation between disease and weekly periods of time; for many complaints show a disposition to end in about seven days, more or less; and it is a subject of constant observation, that miasmatic fevers, when they return after being checked, are apt to do so in one, two, or three weeks, or some other septenary period, most frequently perhaps at the end of the second week. This tendency is, in the present state of our knowledge, quite inexplicable.

Termination.—A particular disease may terminate in convalescence, in some other disease, in the chronic form of the same disease, or in death. *Convalescence* is sometimes sudden. There is an immediate transition from disease to health. This is most apt to happen in nervous affections. But much more frequently the change is gradual. Among the first symptoms of convalescence from acute disease are generally a commencement of the cleaning of the tongue, and a diminution in the frequency of the pulse. The skin, if before dry, is apt to become moist, the other secretions are gradually restored to their normal condition, and all the functions are in the end re-established. Emaciation, however, is usually more striking in convalescence than in the previous illness. This may possibly be in part merely apparent, and the result of the principle of association, which expects healthy looks in returning health; but it is probable that the nutritive process does not at first keep pace with the vigour of absorption, and that the body for a time really loses more than it gains. Convalescence often goes on happily; but often also it is disturbed by unpleasant symptoms, and interrupted by drawbacks, consequent upon the irregular action of the debilitated or perverted functions. Copious night sweats are frequent; the appetite is sometimes feeble, and requires stimulation; the bowels are apt to be constipated; the pulse often remains frequent; and the patient is troubled with various nervous symptoms, such as restlessness, wakefulness, and extraordinary dejection of spirits, or fanciful and hypochondriacal notions. These, however, gradually disappear, spontaneously, or under appropriate treatment; all the functions become active; and the oscillation not unfrequently extends even beyond the original standard of health. The appetite becomes voracious, nutrition abnormally active, and the body swells considerably beyond its previous dimensions. The various sensibilities have been as it were regenerated, everything is for a time enjoyed with the zest of youth, and life has acquired new charms. Sometimes the increased fleshiness continues a confirmed habit of the body; but more frequently it subsides to the original level, and the individual becomes his former self again, with the exception, it may be, of the loss of some previous morbid tendency, or the acquisition of a new one. The hair is very apt to fall after severe illness, and sometimes does not return, especially in advanced life; but generally its place is supplied by a new and equally luxuriant crop. It is thought that shaving the head has the effect of favouring the latter result.

Sometimes convalescence is interrupted by a return of the disease, which is then said to have *relapsed*, and the new attack is called a *relapse*. Some diseases seldom if ever relapse. This is especially the case with those which depend on a specific poison, run a certain course, and are usually taken but once, as smallpox, measles, &c. These not unfrequently leave unpleasant sequelæ behind them; but it is very rarely that they run over their course again. Others are very prone to relapse, as the miasmatic fevers, rheumatism, and the phlegmasiæ generally. In relapses, the patient suffers under the disadvantage of the debility and unrepaired mischief of the first attack, and, therefore, not unfrequently sinks; though the real force of the returning, is usually less than that of the original disease.

Convalescence is sometimes imperfect, and the health is not completely re-established for months or years, if ever. Sometimes a tendency to a new disease is awakened. Thus, phthisis and scrofula frequently follow attacks of the exanthematous fevers. Sometimes, an organ which has suffered in the disease cannot recover itself; sometimes, again, the vigour of the vital functions is permanently impaired, and dropsy, anæmia, or other cachectic condition is established.

Not unfrequently, an acute disease becomes chronic. The symptoms subside without disappearing. The result here is not a new disease called into action or generated by the old, but it is a continuance of the latter, with its essential characters, though much modified in degree, and sometimes in the phenomena.

The termination in death may take place either by a general exhaustion of the powers of the system, so that the flame of life lessens and lessens until it goes out; or in consequence of the failure of one or more of the functions, the integrity of which is necessary to life. The latter mode of death is beyond all comparison the most frequent. It is seldom, indeed, that the vital powers give way so gradually and equally throughout the system, that it is impossible to say that any one part or function suffers prominently, and becomes the immediate avenue by which life escapes. In almost all cases, whatever may be the nature of the disease, death approaches through one of three vital organs; namely, the lungs, the brain, or the heart. When respiration ceases, the blood can no longer circulate through the lungs. It is arrested in the capillaries of that organ, and death necessarily follows, unless the respiration is restored. The heart ceases to act, and all other organs cease to act, because the necessary support of their functions is denied to them by the stoppage of the blood in the lungs. Death, under such circumstances, takes place by *asphyxia*, or, as it may be more appropriately denominated, *apnœa*. The brain presides, as the centre of the nervous actions, and the great link which binds the functions together, over all the vital processes; and none can go on without its continued influence. If the brain become powerless, respiration must cease, the circulation must cease, and life of course along with them. Death may now be said to occur by *coma*. But both the lungs and the brain may be perfectly sound, and death may come through the heart; the morbid cause acting directly on that organ. In this case, death is said to take place by *syncope*.

For a longer or shorter period before death, certain symptoms usually appear which mark its inevitable approach. The patient, under these circumstances, is said to be dying. Sensation and consciousness are extremely imperfect or quite lost; the features are collapsed and without expression; the under jaw is often fallen; speech and deglutition are difficult or impossible; there is often rattling in the throat, from the inability of the patient to expectorate; respiration is irregular, at first sometimes hurried, but gradually becoming less and less frequent, with intervals gradually lengthening until it ceases; the pulse is usually small and feeble, often irregular, and sometimes quite absent at the wrist long before death; the extremities are cool; the skin often clammy, and the colour of the surface pale or somewhat livid; and not unfrequently a cadaverous odour may be perceived while the patient still lives. Sometimes death approaches by imperceptible degrees, and the patient passes quietly away as if falling into a breathless sleep; sometimes nature appears to rouse herself for a last struggle, and life ends in convulsions. This dying state is called the agony, though very improperly; for in most cases it is without a struggle, and very generally without pain or consciousness. Its duration is very various, sometimes not so much as an hour, sometimes several hours; and instances occur in which the phenomena continue for days before death.

SECTION III.

DIAGNOSIS.

This term is employed in two senses, with a slight shade of difference. In the one sense, it signifies the act of determining the character of diseases, and, in relation to any particular case, of ascertaining what disease it is with which the patient may be affected; in the other, it distinguishes diseases one from another by comparing them, and, in relation to particular cases, ascertains what the disease is by determining what it is not. It is used here in both senses. A disease is sometimes so well characterized, that it is immediately known as soon as its symptoms are seen. In such a case, it would be quite supererogatory to bring under examination a number of other diseases, in order to show that, though their symptoms may be somewhat analogous to those of the case before us, they are not actually the disease in question. But, in many instances, the signs of very different diseases are so much alike, that without caution they might be readily confounded. In such instances, it is advisable to compare the symptoms carefully with those of all the diseases about which there might be doubt, and, determining which must be excluded, to narrow down the circle at last to the true one.

It is always proper to look beyond the symptoms to the disease. We ought never to be content with putting certain morbid phenomena together, and calling them a disease; but should endeavour to penetrate to their source. Sometimes, it is true, our search will be fruitless, and we shall be compelled to remain content with the mere symptoms; but, should we never proceed farther than these, the science of pathology would soon cease to make progress.

Having determined the character of a disease, we should next direct a particular attention to all the modifying circumstances; such as the peculiar influence which may have been exerted by the cause, the qualifying effects of various subordinate agencies, the secondary affections which may have sprung up, and all incidental complications.

In making out the nature of a disease, when doubtful, it is sometimes necessary to call to our aid every kind of information which has any bearing upon the subject. We must carefully examine all the symptoms, must inquire into the cause, and must take into view all controlling influences, as age, sex, temperament, constitutional peculiarities whether original or acquired, habits of life, pursuits of pleasure or business, climate, residence, &c. Accidental circumstances will sometimes aid us considerably, when the patient is unable or unwilling to answer our questions. Thus, the remains of food in or about the mouth, the colour imparted by substances which may have been chewed or swallowed to the tongue, teeth, and lips, the colour of the hands, stains upon the face and clothing, as of white lead, &c., are circumstances which may lead to valuable inferences as to what the patient may have taken, his trade, or the accidents to which he may have been exposed. In cases, however, which are not doubtful, a too curious prying into all these circumstances should be avoided, as often vexatious and sometimes injurious to the patient, and at best a mere waste of time.

Now there are certain symptoms belonging to each complaint, by which it may be more certainly distinguished than by others, and which, when found together, determine the nature of the disease. These are called *diagnostic symptoms*. Those belonging to the several diseases should be fixed in the memory, so that when we go to the examination of any case, we may be prepared to recognize one of these characteristic groups, if presented, and thus come to a speedy conclusion.

Again, there are diseases that offer some one peculiar symptom, found in them, and under similar circumstances in no others, which fixes at once, when observed, the character of the affection. Symptoms of this kind are named *pathognomonic*. Thus, an eruption of red spots like flea bites, preceded by a fever of three or four days, which subsides on their appearance, is a pathognomonic symptom of smallpox. But such symptoms are unfortunately very rare. In the strictest sense of the term, they are even rarer than, at first thought, they might be imagined to be; for there is almost always something more than the bare symptom itself, necessary to give it the characteristic certainty. Thus, in the case above alluded to, the red spots would have no force, unless accompanied with the circumstances mentioned.

Certain rules ought to be observed in conducting a diagnostic examination. The physician should guard against a too purely scientific or professional feeling. He should not regard his patient as a mere subject for medical analysis; but should consult his feelings, prejudices, and mental peculiarities; and should endeavour, while attaining his own conclusions, to do so with as little that is disagreeable, and as much that is agreeable to the person chiefly interested as possible. Attention to this rule is not only useful to the business interests of the physician, by producing kindly impressions, but greatly promotes his immediate object, by securing the hearty co-operation of the patient, and the favourable effects of confidence in his medical adviser.

In his examinations, the physician should put as few leading questions as possible. The patient is very apt to imagine that he feels what his attendant may suggest as possible or probable, and may, therefore, by his answers, innocently occasion or confirm an error. He should, at first at least, be induced to give an account of his own symptoms; the physician only interfering to secure a proper order to his remarks.

It occasionally becomes necessary, in persons disposed, from false modesty or a worse cause, to conceal their symptoms, to set on foot a system of cross-examination; but this should be done in a manner least likely to excite unkindness; and when, especially in the cases of young females, information can be obtained from the mother or attendants, it is infinitely better to procure it thus, at second hand, than to extort it by a sort of violence from the subject.

In examining young children, great care must be taken to avoid exciting them. Perfectly correct inferences can seldom be drawn from the examination of a crying and struggling infant. Mothers and nurses are often greatly in fault in this respect. To secure temporary obedience, they often alarm the child by threats of what the physician will do, and thus render his medical attendant an object of terror. There is not the shadow of a doubt, that the most fatal consequences have ensued from this error on the part of weak or wicked care-takers of the young; and every physician should inculcate upon the parents, in whose families he may attend, the importance of teaching their children rather to love than to fear him.

In pursuing his investigations, the physician should observe some order. He will thus save time, and gain clearer notions than by a helter skelter examination, which, in its devious course, must often return upon itself. In general, when the organ or function affected is obvious, this should first engage attention. Afterwards, or originally in cases of any degree of obscurity, it is probably the best course, first to take a survey of the exterior, and then to interrogate the several functions successively, beginning with the digestive, and following with the others in their natural order, as observed in the foregoing general history of symptoms, namely, the absorbent, the respiratory, the circulatory, the nutritive, the secretory, the sensorial, the intellectual and emotional, the motor, and the reproductive. One accustomed to examinations of this kind can run through the whole routine very rapidly, and often a glance at the function is sufficient to show that it is sound or otherwise.

In order to complete the subject of diagnosis, it is necessary that some account should be given of the modes of proceeding, and the implements to be employed. The exploratory processes which require distinct notice may be included under the heads of *inspection*, *palpation* or the touch, *pressure*, *succussion*, *percussion*, *measurement*, and *auscultation*.

1. *Inspection.*—Very many symptoms are observed by simple inspection. This is obviously the case with most of those which are quite external. Such are the attitudes and movements of the patient, the general form of his body and the relation of its parts, the degree of fulness or emaciation general and local, the colour and other appearances of the skin, the condition of the several features, the expression of the face, and all the other physical characteristics, so far as they are visible. We can, to a certain extent, penetrate by our vision into the interior of the body. Thus, we can examine the mouth and fauces directly by the eye. In the inspection of the fauces, the mouth should be opened as widely as possible, and the tongue, without being in the least protruded, should be depressed by the handle of a silver tablespoon, an ivory folder, or wooden spatula, or even the finger, if no more convenient instrument should be at hand. Many persons have the faculty of so opening the mouth as to exhibit the fauces without the aid of an instrument. In others, the object can be accomplished by directing them to open the mouth, and then quickly make a short, and as it were spasmodic inspiration. In cases of infants, who cannot or will not protrude the tongue, the mouth can often be sufficiently examined by allowing them to cry. Instruments, called *speculums*, have been invented for the inspection of internal parts, which the eye cannot reach. By this means, the state of the uterus can often be very advantageously ascertained; and the rectum, bladder, and throat have to a certain extent been examined in the same way.

2. *Touch.—Palpation.*—In this process, the flat of the hand, or of one or more of the fingers, is laid gently, and without pressure, on the portion of surface to be examined. Care should be taken that the temperature of the hand should be as near the ordinary healthy medium as possible. In this way, we can judge of the temperature of the surface, of certain physical properties of the skin, as its dryness or moisture, its harshness, roughness, softness, smoothness, &c., and of certain internal movements, which are communicated to the superficies of the body. One of these movements is a certain fremitus, thrill, or vibration, produced in certain morbid states by coughing, respiration, &c. Another is pulsation, whether natural or morbid. A third is fluctuation, which is felt by the hand applied in the manner above directed, when percussion is made in the same neighbourhood, or on the opposite side of a collection of liquid. A fourth is the movement of tumours, which is sometimes made sensible to the hand by a change of position in the body, or by pressure with the other hand. In performing the process, the hand should be applied accurately to the surface. Sometimes it will be proper that the skin should be protected by a thin covering of soft linen or muslin.

Another mode of gaining information by the touch is by introducing the index finger into the fauces or posterior nares, the vagina, or the rectum. The nail of the finger should always be cut short, in order to avoid wounding or irritating the mucous membrane, and, in examinations per anum and vaginam, its surface should be well covered with lard or olive oil.

3. *Pressure.*—This may be made by the bulbous ends of the fingers, or by the whole palm of the hand. It detects tenderness and deficient sensibility, hardness and softness, firmness and flaccidity, elasticity, and fluctuation. It occasions *crepitation* when the cellular tissue is filled with air, and *pitting* when it is edematous. It enables us to ascertain the existence of air in the bowels by giving rise to a gurgling sound. By means of it, too, we discover the force of the pulse, the rapidity of circulation in the capillaries, and whether a red spot upon the skin is the result of extravasated blood or of inflammation. Generally, the pressure is made equably, with a force proportionate to the depth to be explored. Occasionally, however, advantage may accrue from a quick, short, pretty strong pressure with the ends of the fingers, in detecting deep seated tumours, especially in the abdomen.

4. *Succussion.*—This term is applied to a quick shaking motion, communicated to the trunk of a patient. It may be effected by placing the hands upon the shoulders of the patient, and moving his body quickly backward and forward, or by putting one hand on each side of the chest, and moving it in the same manner laterally. When water and air exist together in a cavity, a sort of splashing sound may thus be produced, which serves to detect that particular morbid condition.

5. *Percussion.*—This process consists in striking upon the surface with the view either of eliciting sound, by the nature of which a judgment may be made of the condition of the parts beneath, or of producing fluctuating or vibratory movements in liquids, by which their presence may be detected.

When percussion is made over a considerable cavity filled with air, a hollow, drum-like, or *tympanitic* sound is produced. An example of this sound is often afforded by the stomach and bowels, even in a perfectly healthy state. When the parts beneath are of a loose texture, consisting of small cells containing air, the sound is less loud and hollow, but is still *clear.* Such is the sound elicited by percussing the chest, over the healthy lungs. When the subjacent substance is solid or liquid, the sound is *dull* or *flat;* and the degree of dullness or flatness is proportionate to the density and want of elasticity. An elastic body, like cartilage, is much more resonant than a soft, inelastic body, like muscle or fat. When liquids are contained in the same general cavity with gases, a peculiar tone is often given to the drum-like sound. The nature of the surface percussed has some influence upon the sound elicited from beneath. Thus, percussion on a tense elastic surface produces a greater resonance than upon a slack inelastic one; because it is by the vibrations of the surface that sonorous movements are produced in the structure or masses underneath it.

Percussion, as above stated, may also be made in reference to the sense of touch. By exciting fluctuation, by means of one hand, in this manner, in a collection of liquid, the movement may often be readily perceived by the flat of the other hand laid upon the surface. This is strikingly exemplified in abdominal dropsy, in which the liquid is readily detected by placing the palm of the left hand upon one side, and striking quickly with the fingers of the right hand on the opposite side. Percussion over a hydatid tumour produces in it a vibratory movement, which imparts a peculiar and characteristic thrill to the hand upon the surface, as observed by M. Piorry.

It is obvious that, by this process, we may discover the abnormal existence of solids or liquids in the interior where air should be, and, on the contrary, the existence of air where there should be none. We can also frequently detect the extent and degree of the morbid change. But it is equally obvious that, in order to draw any just inferences, we must first have familiarized ourselves with the sounds emitted by the parts liable to examination in a state of health, and with the peculiar character of the sounds by which peculiar changes are indicated. Hence, every student should early begin to educate his ear in reference to this process, by frequent practice both upon the healthy and diseased subject. To Avenbrugger, who published his observations in 1761, we are indebted for the first application of this process to the diagnosis of diseases of the chest; but, since his time, it has been greatly extended and improved. At present, it is one of our most valuable means of diagnosis, not only in thoracic, but also in abdominal diseases.

There are two modes in which percussion may be performed; to wit, immediately with the fingers upon the surface of the body, or by the intervention of some elastic solid. Practised in the former mode, it is said to be *immediate*, in the latter *mediate*. The former plan was employed by Avenbrugger, the latter was invented by M. Piorry, who gave the name of *pleximeter* (from πλήξις, percussion, and μετρον, measure), to the intervening body.

In immediate percussion, the ends of the four fingers, with the nails pared, should be brought together at the same level, and supported by the thumb; and the impulse should be given perpendicularly to the surface. Another mode, sometimes very convenient, is to place one finger upon or near the surface, and to cause the next finger previously placed on the top of the first, to slip off from it with some force upon the skin. This is *filliping*. Or, when only a slight impression is desired, the surface may be tapped lightly by the flat of one or more fingers near their tip. To prevent the clicking sound produced by the contact of the finger with the skin, which interferes somewhat with the sound to be elicited from beneath, it is advised to cover the surface with a piece of soft and thin, close-fitting muslin or linen. But this mode of percussion is often painful to the patient, and the difference in the nature of the surface percussed causes differences in the sounds produced, which it is difficult always justly to discriminate. Mediate percussion is, therefore, generally preferable.

The instrument employed in mediate percussion may be a flat, oval, or circular piece of ivory, an inch or an inch and a half in diameter, a large silver coin, or a flat piece of firm caoutchouc, which is preferable to the others as it makes less sound of its own with the ends of the fingers. But, upon the whole, the best and certainly the most convenient pleximeter, is the left index or middle finger of the operator, with its flat surface fitted accurately to the part to be examined. Percussion is made with one, two, or three fingers, the ends being placed together, and brought down perpendicularly upon the pleximeter. The nails should be short, so as to prevent the clicking sound produced by them. The blow should be quick, and made exclusively by the movement of the wrist, and never by that of the elbow, which would give too much force to the impulse. Some substitute for the fingers a very light hammer, the head of which may be made of wood or ivory, with its percussing surface protected by a softish, somewhat elastic substance, as felt or caoutchouc, so as to lessen the force, and prevent interfering sounds. Caution, however, is requisite, in the use of such an instrument, to avoid too heavy a blow. The force of the stroke must vary with the objects to be obtained, and the tenderness of the parts percussed. When it is desired to elicit the sound of a deep-lying part, the force must be greater than when one more superficial is to be examined. Very different sounds are produced by varying the degree of force, when bodies of unequal density lie at different depths.

M. Poirson, of Paris, recommends that percussion should be performed by means of a common sewing thimble, placed on the middle or fore-finger, so as to include a small portion of air between the end of the finger and that of the thimble. The intensity of the sound elicited is said to be thus greatly increased. (*Lond. Med. Gaz.*, Jan. 1850, p. 163.)

The surface to be percussed should be naked, or slightly covered. The position of the body must be influenced by circumstances; and it is very often desirable to change the posture, while percussion is continued upon the same spot. In this way the motion of liquids, or of air in the body, may often be detected.

A new mode of percussion has been proposed by M. Martin Solon, consisting in the application of the palm of the hand to the part to be percussed, and striking upon the back of it with the closed fist of the other hand. Pain is thus produced in a diseased organ which is not sensible to mere pressure; and occasionally, through the *contre coup*, an organ on the opposite side of the body to that upon which the blow is given affords evidence of disease by pain, which is not elicited by direct percussion. Thus, painful sensations in the liver sometimes follow a blow over the region of the spleen, which an equal force applied directly to the hepatic region fails to produce. (*Journ. de Med. et Chirurg. Practiques*, June, 1849.)

By a judicious combination of touch, pressure, and percussion, many important problems in diagnosis may be very satisfactorily solved, especially in relation to diseases of the chest and abdomen.

Measurement.—By this process we ascertain the dimensions of different parts of the body more accurately than can be done by the eye. It enables us to determine whether the whole, or any particular portion is enlarged or diminished, or whether the due symmetry may have been lost by partial change of dimensions. In the healthy and normal state of the frame, the two sides very nearly correspond, the right being perhaps, as a general rule, somewhat larger, in consequence of its more frequent exercise. By discovering any considerable departure from this symmetry, we may often detect the existence of disease; though it is necessary to bear in mind that natural deformities in this respect are not uncommon, without in any degree interfering with the health. Perhaps the most useful application of this process is to the detection of any increase or diminution of bulk in a given time.

The most convenient instrument for measurement is a tape of linen, or other unextensible material, about two yards in length, and graduated in inches and quarters, which may be kept wound up in a circular box. Another instrument, by which the diameter of a part may be measured, is a large pair of compasses, called *callipers*, with blunt points, and a graduated scale, which serves to measure the angle, and consequently the distance between the points.

In applying this process, caution should be used not to make unequal pressure; and, when the measurement is to be comparative, to take care that it should be made at exactly the same, or at corresponding points, in the same position of the body, and in the same state of the function, if that be one of sensible motion. Thus, in determining the dimensions of the chest, we should make the examination at the same period of inspiration or expiration. In measuring the lengths of the lower limbs, reference should always be had to the obliquity of the pelvis.

Auscultation.—This term, in its technical sense, signifies the act of listening to the sounds developed in the interior of the body, and made sensible upon the surface. It was the justly celebrated Laennec who first applied the process to the diagnosis of disease. His discovery has been of incalculable importance to medical science. It was like a new sense given to our art, and has probably served more than any other single discovery, in the present century, to extend the boundaries of medical knowledge, and to give precision to what was before vaguely known.

Auscultation is performed either directly by the ear applied to the surface, or indirectly by means of an instrument called the stethoscope. Performed in the former mode, it is said to be *immediate*, in the latter, *mediate*. Laennec preferred the use of the stethoscope; but his arguments in its favour have not been considered conclusive; and immediate auscultation is now generally preferred, unless under peculiar circumstances. The ear is the most convenient instrument. It is always at hand, and, by the facility with which it can be applied, and the quickness with which it can pass from point to point, saves much time. The head receives, by this plan, a support against the body of the patient; and the attention is not distracted by the necessity of holding it in an awkward and sometimes painful position. The sounds are not confused by the noise which the instrument makes with every movement upon the ear, and the operator is spared the trouble of keeping it properly fixed at both extremities. When the surface is uncleanly, it can be covered with a clean towel, or, if necessary, by a piece of soft and thin oil-cloth. There are, however, circumstances in which the stethoscope is preferable. In the cases of females, it must often be so upon a point of delicacy. When it is desirable to estimate sounds in a very narrow space, as over the valves of the heart, for example, the instrument is almost essential. It is also applicable to cases in which the place to be examined cannot be readily reached by the ear; as in the hollow which, in emaciated patients, often exists beneath the clavicle.

The stethoscope is a hollow cylinder of soft light wood, or of gutta percha, from five to seven inches long, with the bore a quarter of an inch in diameter, but, towards the base, enlarging into a funnel-shaped expansion, so as to admit sound from a larger surface. The diameter of the opening at the lower extremity should be an inch, or a little more. The upper end is fitted with an ear piece, which may be either flat or slightly convex, and is sometimes furnished with a nipple-shaped projection for insertion into the ear. When the instrument is employed to detect sounds within very narrow limits, its larger extremity should be fitted with a conical piece of wood, having a bore through it corresponding with that in the upper portion of the instrument, so as to form a continuous equable tube. The sound is then conveyed distinctly to the ear only from the portion of surface corresponding with the narrowed opening of the instrument.

A flexible tube has been introduced into use, as a substitute for the wooden stethoscope, by Dr. Pennock, of Philadelphia, who found it especially adapted to the investigation of the sounds of the heart. It is made like the flexible ear-trumpet, is about eighteen inches long, and is provided at one end with a piece of ivory to adapt it to the ear, and at the other with an expanded termination for application to the chest. The advantage of this instrument in cardiac diseases is, that it does not, like the common stethoscope, convey to the ear the impulse along with the sounds of the heart.

In applying the stethoscope, care must be taken that it be accurately adapted to the part as well as to the ear, and that, though held firmly, it should not be pressed forcibly, so as to occasion discomfort.

Whether immediate or mediate auscultation be employed, the surface, as a general rule, should either be naked, or covered only with a slight and closely fitting material, of such a nature as not to rustle with movement. Sometimes the sounds are so decided that they can be heard through a considerable thickness of clothing; and, in such cases, the above caution may not be absolutely necessary. But there is always danger of confusing the sounds of the interior with those made by the friction of two layers of clothing upon the surface. It should not be forgotten, in employing this process, that there is often great danger of taking cold from the exposure of a naked, or but slightly covered surface to the cold air.. The exterior air, therefore, should be duly warm, and the exposure should continue no longer than necessary. I have no doubt that patients, with disease of the chest, often suffer greatly from a neglect of this caution. It has been ascertained that the muscles give rise, during their contraction, to a sound which is audible in auscultation. When, therefore, the examination is made in reference to an internal part, the muscle which may be beneath the ear should always be in a state of relaxation. When stooping, as often happens, affects the hearing, and confuses the perceptions of the operator, he should perform the process either sitting, or kneeling by the bedside. He should always also avoid constrained positions, which must tend to distract his attention. If he should happen to hear better with one ear than with the other, he should always employ the most delicate preferably. The sounds observed in auscultation, as well as their indications, will be subjects of detail under the particular diseases in the diagnosis of which they are available.

Auscultation and percussion may sometimes be advantageously united, as originally hinted by Laennec,* and conclusively shown by Drs. P. Cammann and A. Clark, of New York. (See *New York Journ. of Med. and Surg.*, July, 1840.) By means of a stethoscope applied to the surface of the body, the ear will sometimes distinguish sounds produced by percussion, which are quite inappreciable without such aid. The precise limits of different organs, the existence and position of organic changes, and the continuity or separation of contiguous solid bodies, may thus be more certainly detected than by percussion alone.

Chemical and *Microscopical* examinations may sometimes be employed by the practitioner with advantage in diagnosis. Chemical tests are indispensable in the detection of certain important morbid states of the urine, and they have been successfully applied also to the detection of bile, and to the appreciation of the condition of the blood. The microscope is useful, in numerous instances, in detecting diseased conditions of the blood and the secretions, and in distinguishing one morbid product from another.

SECTION IV.

PROGNOSIS.

This is the decision of the judgment as to the future course of any disease, including its changes and termination, and the periods at which they are likely to occur. We are guided, in making such a decision, by our knowledge of the course which the same disease has ordinarily pursued, together with the peculiar circumstances which may modify the case under consideration. In most instances, only probable opinions can be formed of precise results, though it very often happens that the main result may be predicted, with great confidence, in general terms. Thus, certain diseases almost always end in recovery, others with a more than equal universality have a fatal termination. But we cannot determine, with precision, the period of these changes. Some complaints run a specific course, having certain stages, and ending, as a general rule, about the same time. In relation to these, we may ordinarily make our predictions with some confidence. Others, again, without anything specific in their nature, are apt to terminate within certain limits, as from seven to ten days; and these too occasionally admit of a tolerably correct prognosis. But, even in cases of this kind, so many accidents occur to change the accustomed course, so many inappreciable influences are at work of which the effects cannot be calculated, that predictions should almost always be made with caution. A physician may gain some reputation by a happy guess, announced with an appearance of confidence; but the habit of making such guesses must often end in discreditable failure, and, at all events, is scarcely consistent with a proper self-respect.

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* See Laennec on Mediate Auscultation, in the third article of chap. iv., on Pneumothorax.

In cases of great danger, yet not incurable, much caution is requisite in making the patient acquainted with his condition, as the effect on his mind might insure the worst issue to the disease. Yet moral considerations should have some weight; and a conscientious physician may well doubt the propriety of withholding information, which may be essential to higher interests even than those of life. Under these circumstances, it appears to me that no exclusive course can be pursued with propriety. As a general rule, it is probably best that the patient should not be informed of his danger; but, should he seriously ask for information, and his mind appear to the physician in a state capable of properly using it, I do not think that it should be withheld. My own practice has usually been to warn the friends of the patient of his danger, and leave to them, who better understand his spiritual wants than the physician generally can do, the care of his interests in that respect, making them, however, fully understand whatever risk may be incurred.

It has been stated above that the peculiar circumstances which can have any modifying influence over the disease, must be taken into consideration in forming a prognosis. Age, sex, modes of life, place of residence, previous state of health, &c. &c., are circumstances of the kind alluded to. It not unfrequently happens that certain diseases are peculiarly dangerous, under certain peculiar influences; while there are influences which add increased danger to diseases of all kinds which may be exposed to them. Extreme old age, the puerperal state, habitual intemperance, long continued mental distress, exhaustion from sensual excesses, and debility from previous disease, impoverished diet, or impure air, usually augment the gravity of the disease, and consequently render the prognosis more unfavourable. Cases of disease at the commencement of epidemics are often much more severe than those which occur near their close. Youth, previous health, temperance, easy circumstances, and a cheerful temperament, exercise a favourable influence on disease, and of course on the prognosis.

Certain symptoms, or conditions of system, may generally be considered as extremely unfavourable signs. Such is the case, in chronic diseases, with dropsy supervening upon organic affection, progressive emaciation without an obvious cause, and the appearance of aphthæ in the mouth and fauces. Such, too, in the latter stage of disease, are the hippocratic countenance; involuntary fecal evacuations; a tendency to slide downward in bed; delirium, in which the patient wishes to return home when not absent from home, or in which, though greatly enfeebled by disease, he is yet able to rise out of bed and walk some distance; extreme subsultus tendinum; a disposition, alluded to by Chomel as an almost certain sign of approaching death, to draw the arm towards the body, when it is raised in order that the pulse may be felt; difficulty or impossibility of protruding the tongue, or trembling in that organ when it is protruded; difficulty of deglutition or speech; the absence of pulse; great coldness of the extremities; excessive frequency of breathing; hiccough; black vomit; and a purple or livid appearance of existing wounds or ulcers. Signs of a favourable issue are, the occurrence of critical symptoms when not extreme, and a gradual subsidence of the symptoms, indicated by cleaning of the tongue, a return of the pulse towards its healthy state, a return of the normal temperature of the skin, &c. (See *Convalescence*, p. 197.)

CHAPTER IV.

GENERAL THERAPEUTICS.

It is a question of great importance, how far it may be proper for the physician to interfere in the management of diseases. There is no doubt that too much may be and often has been done, and that as much evil may accrue from this cause as from doing too little. The young practitioner should be strongly impressed with the truth, that, in the great majority of cases, disease will end in recovery, whether under treatment or not. He is not to suppose that every instance of recovery under his management is a cure. The prevalence of empiricism is, in a considerable degree, ascribable to the popular error, that a favourable termination of disease is always owing to the means employed. Patients often survive improper and even injurious treatment, and, believing themselves cured, naturally acquire confidence in the practitioner, or in the supposed remedy. Medical men may do much towards obviating the evil, by imbuing the popular mind with accurate notions in this respect. But they should especially guard themselves against a participation in the error. An impression that medicines are essential or important, in all cases, will often lead to their unnecessary, and even to their injurious employment. It cannot be doubted that diseases, which, if undisturbed, would have spontaneously terminated in health, have often received an unfavourable turn from officious interference.

But it must not be inferred from what has been said that the intervention of the physician is useless. On the contrary, even in the cases which would end favourably if trusted to nature alone, he may often do much good by shortening the duration of the complaint, alleviating the sufferings of the patient, and preventing inconvenient if not dangerous sequelæ. In many cases, his aid is essential to the preservation of life. While, therefore, we guard ourselves against the evils of an overweening confidence in the efficacy of therapeutical measures, we should equally avoid the no less injurious influence of utter scepticism. Such, however, is the nature of our art, that experience or observation alone can give the necessary acumen for a proper decision, as to the greater or less energy of the means required in most individual cases. The most that precept can do is to call attention to the importance of a just discrimination in this respect.

In the treatment of disease, we should endeavour to be guided by certain rules or principles, and not surrender ourselves to the accidental suggestions of the moment. The attempt should always be made, by a careful examination into the nature, seat, cause, &c., of the disease, to deduce indications of treatment; in other words, reasons for the employment of certain influences calculated to prove remedial. The character of these influences being known, it then only remains to fulfil the indications which may have been deduced. It is the object of the present essay to present, first, certain general therapeutical indications, and, secondly, an account equally general of the remedial measures that may be employed to meet them.

It often, however, happens that the nature of the disease is so obscure as to offer no clear indications of treatment. Under such circumstances, we may obey the dictates of experience alone, and employ measures which have repeatedly succeeded in similar cases, though not suggested by any rational view of the disease. The science of medicine is yet very imperfect; and we must often content ourselves with means which we know to be useful, without understanding fully their modes of action.

In doubtful cases, when both reason and experience fail us, the best rule is to adopt the *expectant plan;* that is, to do little or nothing which can strongly impress the system, and await further developements, trusting in the mean time to nature. Measures employed in the dark are much more likely to prove noxious than remedial.

SECTION I.

GENERAL INDICATIONS.

1. The removal of the morbid cause is among the most important therapeutical indications. In many cases, the disease is sustained solely by its continuance, and yields immediately when it ceases to operate. Thus, nervous headaches often depend upon the habitual use of coffee, dyspepsia upon indigestible food with want of exercise, and colic upon irritant matters in the bowels; and the list might be extended through a long catalogue of diseases. In all such instances, little more is required of the physician than to ascertain and remove the cause. In other cases, though the disease may not yield immediately after the cause has ceased, it is greatly aggravated by its continuance, and often cannot be cured until after its removal. Thus, cholera infantum frequently bids defiance to medicine, while the patient is confined to the air of cities; and the chronic hepatitis of hot climates can be cured, in many instances, only by residence in cold or temperate latitudes. Here, attention to the indication at present under consideration is indispensable. In a third set of cases, the cause either adds nothing, by its continuance, to the violence of the disease when once produced, as probably in smallpox, measles, scarlatina, &c., or ceases immediately after it has produced its effect, as often in inflammatory diseases resulting from cold. In such instances, attention to the cause is important, in a therapeutical point of view, only so far as a knowledge of it may lead to a more correct estimate of the nature of the disease. In searching for the cause of disease, in reference to its removal, the attention must be directed not only to exterior agents, but to those also which may exist within the system. One morbid action or condition is very frequently the result of another; and, in such cases, the removal of the cause of the former affection often implies the cure of the latter.

2. Attention having been directed to the cause of the disease, we should next inquire into its precise seat, and endeavour to ascertain whether or no this is primarily or essentially in the blood. If it prove to be so, the prominent indication will be to correct the state of that fluid. Much time is often lost by a neglect of this precaution. I have known cases to run on for weeks and months, obstinately resisting various courses of treatment, or, if apparently relieved for a time, quickly relapsing into their previous condition, which have yielded, immediately and permanently, to measures calculated to restore the healthy condition of the blood. Of these measures, attention to the diet is among the most effectual; though medicines and other remedial means are not without an important influence. As examples of diseases in which the blood is mainly concerned, the reader is referred to plethora, anæmia, scurvy, and purpura.

3. In relation to diseases affecting the solids, which include the vast majority

of morbid affections, an obvious indication is to restore their due grade to the vital actions, whether these be elevated or depressed, and whether the affection reside in a part or the whole of the system. Peculiarities in the character of the elevation or depression, or mere perversions of the vital actions, without obvious deviation from the healthy grade, must be encountered by means which experience may have pointed out as best fitted to answer the end in view.

4. The course, natural tendency, and natural termination of the disease afford important indications.

The practitioner should, in the beginning, carefully note whether the disease is regularly *intermittent* or not. In the former case, no matter what may, in other respects, be the nature of the affection, it will almost always yield readily to treatment. Patients have often been unnecessarily exposed to protracted suffering, from a neglect of this precaution on the part of their attending physician. Whenever complaint is made of fever, pain, or other disordered action or sensation, occurring at a particular time every day or every other day, and going off after a longer or shorter duration, with perfect freedom from the affection in the interval, there is every reason to expect that a cure may be effected, in the course of two or three days, by an energetic employment of the remedies denominated anti-periodic or anti-intermittent. These remedies will be detailed in the article upon the subject of intermittent fever.

Should the disease be *remittent*, efforts should be made to bring it into the intermittent form, by the use of means calculated to resolve the paroxysm; and this may sometimes be accomplished by watching the process by which nature appears disposed to effect the same object, and assisting her by appropriate measures. Thus, the paroxysm of a remittent fever may sometimes be entirely resolved by favouring the natural tendency to perspiration, and the disease converted into an intermittent. In very many instances, remittent diseases, especially when the remission is considerable, will yield entirely to the anti-periodic treatment.

Some diseases run a certain course, which cannot be interrupted unless by the destruction, or at the risk of life. Such are most of the exanthematous fevers. In these, when fully formed, it would be the height of folly to attempt, by violent measures, to interrupt their progress. The practitioner should be content with watching them through their course, removing or preventing injurious influences, moderating their violence, correcting as far as possible any tendency to fatal disorganization, and conducting them to a favourable issue. He should never forget that they have a certain term which cannot be shortened; and that, whatever may be done, it is of the utmost importance not so far to exhaust the strength of the system as to disable it from holding out to the end.

Other diseases are indefinite in their course, having a tendency sooner or later, when not unusually violent, to a favourable termination, and often capable of being arrested or shortened. In the treatment of these, the practitioner should be influenced by the degree of apparent danger. Should they be very threatening, he would be justified in employing energetic measures to arrest them, even at some risk. Should they, on the contrary, be moderate, and likely to end spontaneously in health, he should be more cautious in the use of remedies, lest he may injuriously interfere with the processes of nature, and put at hazard what might otherwise be safe. Remedies should always bear a relation to the disease; and violence in therapeutics is never justifiable when moderation is adequate to the same good end. Another important rule, is not to change a plan of treatment which is doing well, in the mere hope of doing better. "Let well enough alone" is a vulgar maxim, not less applicable to therapeutics than to the ordinary concerns of life.

A third set of diseases, though not incurable, have a tendency to a fatal termination, unless interrupted. These must be checked at all events, mild measures being employed if sufficient, but the most energetic if necessary.

Lastly, there are diseases essentially fatal in their character, for which at least no remedies have yet been discovered. Here, we should make no vain attempts to effect cures by violent remedies, or excessive medication. These only tend to hasten the fatal issue by exhausting the resources of the system. Palliation and alleviation only should be aimed at. By preventing all aggravating influences, and employing means calculated to correct excessive action, or support failing strength, without undue exhaustion in the former case, or undue excitement in the latter, we may often greatly prolong life, and at the same time render it much more tolerable to the patient. In such cases, it is as important not to wear out the excitability of the system by excessive stimulation, as not to exhaust its strength directly by depletion.

5. The *stage* of the disease should always be considered in the application of remedies. In the forming stage, diseases may sometimes be arrested at once by prompt and well-considered measures, which would be useless after they have been completely formed. A commencing catarrh may often be set aside by a dose of opium, which might greatly aggravate it when established. In the earlier stages, diseases almost always bear depletory measures better than in the advanced. A bleeding which would be beneficial in the first few days of a fever or inflammation, might be in the highest degree dangerous towards the close. The contrary is almost always the case with stimulants, which are often requisite to support the system under the exhaustion of an advanced disease, though, if employed in the beginning, they would have been highly injurious. Inflammation, in which depletory and sedative measures are proper in the early stages, often calls for the use of tonics, or more powerful stimulants, to obviate the exhaustion produced by the suppuration or gangrene with which it closes.

6. The supervention of another disease upon the original, or the aggravation of an attendant symptom into an importance exceeding that of the primary affection, are circumstances which call for constant watchfulness on the part of the practitioner, and the occurrence of which often affords new indications of treatment.

7. *The condition of the system at the time of attack* has a most important bearing upon the remedies, and should never be overlooked. The same disease requires a very different treatment in persons of vigorous constitution, with a plethoric circulation, and healthy blood, from that which would be suitable in the feeble, the anemic, and those in whom the blood is depraved or vitiated. An amount of depletion which might be essential in the former, would prove highly dangerous if not fatal in the latter. Hence, it is necessary to take into consideration the various circumstances in which the patient may be habitually placed, and those to which he may have been exposed previously to the commencement of the disease.

Age is not without its influence. *Infancy* is more impressible than manhood, and therefore requires more caution in the use of remedies. Though more rapid in the curative processes, it is yet more readily depressed below the point of reaction. The nervous system at this age is peculiarly susceptible, and frequent calls are made for remedies addressed to the support of that system. This fact is often fatally overlooked in the advanced stages of infantile diseases. *Old age* also demands caution. Though less susceptible than middle life, it is less capable of supporting excesses of any kind, and should, therefore, as a general rule, be treated with more reserve. As the blood is made less rapidly, it should be more sparingly abstracted; and greater care should be observed not to give medicines in over-doses. Even stimulants in excess are less safe than in earlier life, because there is generally some frailty in the organization, especially in the brain, which may cause it to give way under any considerable excess of arterial action.

Sex also has its peculiarities. Woman is to be treated in all respects more delicately than man. During menstruation, peculiar care is required, in the use of remedies, not to interfere with that process; and, as a general rule, unless treatment is imperiously required, it should either be suspended or moderated. Pregnancy also calls for certain cautions. Though it usually tolerates bleeding well, especially when advanced, it contraindicates perturbating treatment, such as the use of violent emetics and cathartics.

The sanguine *temperament* bears depletion better than the phlegmatic or nervous.

Individual peculiarities or *idiosyncrasies* require a careful attention. The practitioner should listen respectfully to the representations of the patient as to any peculiar susceptibilities which he may possess, and, in the absence of such representations, should himself make inquiries upon the point. He will thus be spared many awkward, and some serious or even fatal accidents. Thus, death has resulted from the use of a moderate dose of calomel, which might have been avoided by a previous knowledge of the extraordinary susceptibility of the patient to the mercurial impression. Remedies which usually produce no unpleasant effect whatever, act with great violence in some individuals. I know a lady, in whom the smallest quantity of a decoction of pipsissewa (*Chimaphila umbellata*) produces excessive irritation of the mucous membrane with which it comes in contact, with a fiery eruption upon the skin.

Hereditary tendencies must not be overlooked. In a doubtful case, the scale may often with great propriety incline towards one or the other side, according to the known constitutional habits of the parent. The son of scrofulous parents should, under certain circumstances, be treated very differently from one in whom no morbid hereditary tendency could be suspected.

Climate has a modifying influence over the effect of remedies. Neither bleeding nor general stimulation is so well borne by the inhabitants of hot countries as by those of temperate or cold latitudes; while the influence of calomel as a cathartic is perhaps in general better borne, in consequence of the less susceptibility of the liver.

The *habits* of the patient are of the highest importance, and should always be investigated. Exhaustion from sensual excesses; debility and depravation of the blood from starvation, or from bad food and air; repletion from gluttonous indulgence of the appetite; intemperance in the use of alcoholic drinks; and the influence of occupation and trades, should be taken into account in prescribing. In persons accustomed to excessive eating and drinking, it should be recollected that vast and fatal depression often follows the abstinence consequent upon attacks of illness, against which it is necessary that the practitioner should be on his guard. In such instances, particularly in those of drunkards, it is often necessary to support the tone of the nervous system by the continued use of stimulating drinks, even while bleeding may be rendered necessary by an acute and dangerous attack of inflammation.

Previous disease generally leaves a debility which renders the patient less able to bear depleting or depressing measures. But there is another point of view, in which this influence is to be considered. Peculiar diatheses, such as the rheumatic, the gouty, the tuberculous, &c., often have a wonderfully modifying influence upon accidental diseases, upon which they are apt to impress more or less of their own character. No practitioner can do justice to his patients, who does not bear this fact in mind in prescribing.

8. *Coincident influences* often greatly modify the morbid results of particular causes. Of these, perhaps, the most important are the *miasmatic influence*, and *that of epidemics*. Without attending to these, the practitioner must be liable to the most fatal blunders. It is well known that all the diseases of miasmatic regions assume a character more or less analogous to that of the peculiar fevers by which they are infested. Fevers arising from other causes, and even the ordinary phlegmasiæ, occurring in the autumn and winter, exhibit generally the remittent aspect of the proper miasmatic fever, and, like it, require less depletion than in other situations, and often yield most happily to quinia. Epidemics are notorious for their quality of imparting something of their own nature to all other co-existing diseases. Now sometimes the epidemic influence conduces to a sthenic or vigorous state of system, sometimes to an asthenic, feeble, or typhoid condition. In the former case, diseases ordinarily of a feeble character assume a degree of energy and elevation which requires depletion; in the latter, inflammatory complaints, which usually yield most readily to copious bleeding, sometimes become so prostrate as to forbid evacuation, and even to require the support of active stimulation. This latter effect was frequently witnessed in this country, during the prevalence of our great typhous epidemic.

9. *The pointings of nature* should be watched for, and regarded in the treatment of diseases, even though they may be opposed to the deductions of our reason, and the whole previous course of our experience. Now and then, in the progress of a disease, the patient expresses a wish for some article of food or drink, some medicine, or some change in other respects in his management, which seems to the physician altogether improper. As similar wishes are often the mere result of the restlessness and caprice of disease, it is of course very properly denied by the physician. But if the same wish is repeated time after time, resisting alike the authority of the physician, and the common sense of the patient himself, it acquires an altogether different value. It may now be looked upon as probably a real want of the system, an indication presented by nature, which ought to be indulged. At first, however, it should be gratified cautiously, and in such a manner that little harm could result if it should happen to be a mistake. Should apparent good result from the first careful trial, a greater latitude may be allowed; and the practitioner will often be gratified at witnessing a rapid recovery, dating from the moment of his judicious surrender of his own judgment to this imperious call of the system.

10. It is a good general rule of practice, whatever may be the particular disease under treatment, to attend to the state of the functions, and to correct any disorder in them, even though not directly connected with the disease. The bowels, especially, should be kept regular, and fecal accumulation sedulously guarded against. The secretions of the liver, skin, and kidneys, should be preserved as nearly as possible in a healthy state. Irregularities in the circulation, the diffusion of temperature, and the nervous actions, should also receive attention. As it is not always possible to determine how far diseases are mutually dependent, we may thus occasionally cut off, unknowingly, one of the roots of the principal affection, and render its cure comparatively easy.

11. There are various effects of disease which require treatment, without reference to any morbid condition of the vital actions. Such are certain liquid accumulations, as in different forms of dropsy; organized solid products of deranged secretion, as in the swelling and hardness which inflammation often leaves behind it; and various solid deposits from the fluid secretions, as urinary and biliary calculi. These, however, as they constitute special diseases, and offer special indications, do not call for particular consideration in this place.

SECTION II.

GENERAL THERAPEUTIC PROCESSES.

These may be included under the heads of 1. depletion; 2. repletion; 3. dilution; 4. stimulation; 5. sedation; 6. revulsion; 7. supersession; 8. alteration; 9. elimination; 10. chemical action; and 11. mechanical action.

I. Depletion.—By this term it is intended to express a diminution of the blood, in relation either to the whole mass, or to some one or more of its solid constituents. When a portion of the blood is abstracted, the quality as well as the quantity of that fluid is altered. One of the consequences of diminution in the contents of the blood-vessels is increased absorption; and, as water is absorbed in much greater proportion than the solid principles, the consequence is that the blood becomes diluted. It is, therefore, less stimulant, and less capable of affording the due support to the functions, almost all of which are directly dependent upon it. Depletion consequently tends, by a reduction both in the quantity and quality of the blood, to diminish the vital actions. It depresses especially the force of the heart, and of the whole circulatory system. It diminishes also digestion, respiration, nutrition, secretion, calorification, and the functions of animal life. This last effect is rendered obvious, when depletion is carried to any considerable extent. Languor, impaired sensation, deficient emotional and intellectual energy, muscular weakness, even faintness, and positive syncope, result from the failure of the due influences of the blood upon the brain. But there is one function, that of absorption, which appears to be promoted. To supply the loss of blood, the liquids and solid tissues of the body are taken up with more than the usual rapidity, and water is copiously absorbed from the contents of the alimentary canal, and perhaps also from the external air.

APPLICATIONS.—The therapeutical applications of depletion are obvious. It is the great remedy in plethora, and in excess of vascular excitement, whether that excess amount to irritation merely, or to inflammation. Sanguineous determination and congestion, hemorrhage, morbidly increased secretion, and other derangements of function, so far as these disorders are results of irritation, are to be combatted by means of it. In the treatment of inflammation it is invaluable; not only lessening the force with which the blood is driven into the inflamed part, but impairing those qualities of the vital fluid which most powerfully support that morbid process.

Another application of depletion, dependent upon its influence over the absorbent process, is in the treatment of morbid effusions, the different forms of dropsy, for example, in which it is often employed with great efficacy, though requiring caution. (See *Dropsy.*) Upon the same principle, it may be used in polysarca or morbid obesity.

From what has been stated in a former place (see *pages* 66 and 67), the reader is prepared to understand that depletion is not always purely sedative; and this is a very important therapeutical fact. The general rule may be considered as holding true, whenever the blood is in excess, as regards its animalized or vital constituents. Under these circumstances, therefore, the remedy may be employed without hesitation, if indicated by any obvious derangement. The same is true also, even in the ordinary state of the blood, as regards the immediate effects of depletion, and even its ultimate effects, when moderately used and properly guarded. But copious depletion, when mistakenly used, may act as an excitant instead of a depressing agent to certain functions, and especially those of the heart and nervous system. The functions of the system generally, feeling the want of their wonted support, make this want sensible to the nervous centres, which then transmit a stimulant impression to the heart, while, at the same time, they make known their own disturbance by various irregular nervous phenomena. Under no circumstances, is the heart thrown into more violent commotion than, sometimes, through an impoverished condition of the blood. Depletion, therefore, especially the more direct and powerful kinds of it, should be employed with reserve in anemic states of the circulation, even though strongly indicated by other considerations.

MEANS OF DEPLETION.—Depletion may be effected either directly, by taking blood or promoting secretion, or indirectly, by diminishing the supplies through which the natural losses of that fluid are repaired. Beyond all comparison, the most efficient of these measures is the immediate abstraction of blood from the vessels, either quickly through one large opening in a vein or artery, or by means which withdraw it slowly and through numerous small openings. The former is called *general*, the latter *local bleeding*.

General Bleeding.—When blood is taken directly from an artery, the process is called *arteriotomy;* when from a vein, *venesection.* In the former, the temporal artery is almost always selected; but the operation is scarcely ever employed except in violent diseases of the brain, and is probably never necessary even then. Venesection is almost universally preferred. This is usually performed in the arm, at the bend of the elbow; and, where a vein sufficiently large can be found in this position, there is seldom any necessity for having recourse to another.

The general effects of bleeding are those already detailed as the result of depletion. Its peculiar effect is, at first, merely to diminish the quantity of the circulating mass by the amount abstracted, afterwards to lessen especially the proportion of red corpuscles. It is true that the whole amount of solid ingredients in relation to the liquid is diminished; but the albumen and fibrin suffer less than the coloured constituent, probably because they are more readily supplied from the tissues and food, through the processes of digestion and absorption. Indeed, in inflammation, the proportion of fibrin, according to Andral, even increases up to a certain period, notwithstanding the loss of blood. But, as the red corpuscles are probably the most stimulating ingredient, the effect of the bleeding is greatly to diminish the excitant properties of the blood, even in inflammation.

The loss of a sufficient quantity of blood will always produce syncope; but the amount requisite for this effect varies greatly in different individuals, and in different diseases. In plethora and inflammation, more is required than in health; in anæmia and asthenia, or typhous affections, less; the difference probably depending upon the more or less stimulant quality of the blood. The nature also of the tissue inflamed has some influence upon the tolerance of the loss of blood. It is well known that posture has great effect. When lying down, an individual will bear a greater loss than when sitting, and in this position than when standing. This is owing partly to the effect of gravitation, favouring or otherwise the pressure upon the brain; partly, to the greater amount of blood required to support the increased muscular action, in the two latter postures. According to Dr. Marshall Hall, the mean loss of blood requisite to produce the symptoms of commencing syncope, in the sitting or erect posture, is in health 15 ounces, in congestion of the brain from 40 to 50 ounces, in inflammation of the serous, synovial, or fibrous membranes, from 30 to 40 ounces, in parenchymatous inflammations 30 ounces, in mucous and cutaneous inflammations 16 ounces; while, in eruptive fevers, it is only 12 to 14 ounces, in delirium tremens 10 to 12, in accidents before inflammation has taken place, 8 to 10; and in chlorosis 8. But these are mere approximations; and the numbers are liable to very great diversities. Much depends upon the rapidity with which the blood is drawn. When it flows in a full stream, through a large orifice, faintness is induced by a much smaller quantity than when it is taken very slowly, or by small and repeated portions.

The quantity of blood to be drawn, in any particular case, must vary not only with the tolerance of the individual or the disease, but with the particular object to be accomplished. When strong determinations of blood to the brain, or the lungs, threaten death from cerebral or pulmonary apoplexy; or when violent inflammatory spasm puts life in immediate danger, as in some cases of laryngitis; or when inflammation of extraordinary violence attacks some vital organ, the bleeding may often proceed till symptoms of approaching syncope appear. But, in ordinary cases of vascular irritation or inflammation, this is seldom necessary. It is usually sufficient, in these cases, to produce a sensible diminution in the force of the pulse; and it is safer to bleed a second time, if requisite, than to abstract too much at once. Bleeding to absolute syncope, in fixed affections, is injurious, independently of the mere quantity of blood lost. According to principles sufficiently developed in previous parts of this work, the repose of all the organs, during the state of fainting, increases their excitability; and, when action is restored, it is very apt to run into extremes. Hence, the pulse becomes, under such circumstances, not unfrequently more excited and tumultuous, though less tense, than before the bleeding.

The mode of taking blood varies with the indication to be fulfilled. If syncope or an approach to it be desirable, the orifice should be large; and if it be wished, as may not unfrequently happen, to produce the effect with as little loss of blood as possible, the patient should be bled sitting or standing. If, on the contrary, it is deemed important to take away a large amount of blood, without inducing syncope, the patient should be in a lying position, the orifice should be rather small, and the current occasionally stopped for a time by the finger, so as to allow the heart and brain to accommodate themselves to the diminished tension of their vessels.

In doubtful cases, in which the propriety of bleeding may be uncertain, but in which the strength of inducement may be somewhat in its favour, the patient should be placed, if possible, in the sitting posture, or even upon his feet, and the operation should cease as soon as any signs of faintness appear.

Local Bleeding.—This is usually effected by cupping or leeches. The former is generally preferable, when the surface from which it is desirable to abstract blood is extensive, and not tender under pressure. It also adds the influence of revulsion, through the inflammation excited by the wounds, to that of depletion. Leeches are preferable when the part is tender, when the surface is irregular or of very loose texture, and when it is desirable to concentrate the application within a very small space. They should always be used, preferably, in the cases of infants. In this work, when the number of leeches is mentioned, reference is always had to those of American growth, unless the fact is otherwise expressly stated. European leeches draw much more blood than the American, and, if employed in the number directed for the latter, might produce dangerous exhaustion. The American have the advantages of being more readily procured, more easily regulated in relation to the quantity of blood they draw, and less apt to be followed by obstinate hemorrhage.

Local bleeding is often adequate, of itself, to the cure of inflammation, when this is moderate, and not attended with general excitement. It may also be advantageously employed in those doubtful cases, in which, while an indication for the loss of blood is offered by the existence of inflammation, the general strength may be inadequate to support bleeding from the arm. But, most frequently, it is employed only as an adjuvant to general bleeding. When inflammation is accompanied with fever and a sthenic state of system, cups or leeches, employed in any ordinary measure, are quite inadequate. The capillaries are, in such cases, rapidly refilled through the vis a tergo, and little impression is made on the disease. But, after excitement has been sufficiently subdued by the lancet, or general bleeding has been carried as far as may be deemed consistent with the strength of the patient, local bleeding may often be resorted to, with great advantage, to complete the cure. In infants, however, leeches will frequently answer all the purposes of bleeding from the arm.

Local bleeding has the advantage, over general, of producing a greater effect upon the local disease, with less loss of blood. In order that it may act most effectively, the blood should be taken from the immediate vicinity of the inflamed part, but not, as a general rule, from the inflamed vessels themselves; as the irritation of the wound sometimes increases the disease which the depletion was intended to relieve. The remedy is often applied, with great advantage, in cases of internal inflammation, to the outer surface directly over the part affected. Its efficacy, in such cases, can be readily understood, when the part inflamed has a direct vascular communication with the exterior surface, as in costal pleurisy. The blood may be conceived to proceed immediately from the inflamed vessels. But the remedy proves scarcely less beneficial in the affections of organs which have no such direct connexion, as in mucous gastritis and in bronchitis. Its mode of operating, under these circumstances, is not so easily explained. Some have ascribed the result to derivation; but they do not inform us why the same amount of blood, drawn in another place, would not answer the same purpose; why, for example, it must be taken from the epigastrium in mucous gastritis, and not from between the shoulders, from the breast, or some other part quite as closely connected by vessels as the epigastrium with the mucous membrane of the stomach. I know no better explanation than that which supposes a sympathy to exist between the internal organs and the corresponding portion of the outer surface, by which an impression made on the latter is propagated to the former, through some common nervous centre. This, however, is purely hypothetical.

The quantity of blood which it may be proper to take by cups or leeches has no precise limits. It may not be more than an ounce or two, or it may amount to ten or twelve ounces. Generally, from two to six or eight ounces will be sufficient. Each American leech may be estimated to draw a fluidrachm, or a little more.

Increased Secretion.—This is another very useful mode of depletion. It not only unloads the circulation in general, but, in some cases, has the advantage over bleeding, of directly depleting from the diseased vessels themselves, and thus of imitating a very frequent process of nature in the relief of irritation and inflammation. Thus, cathartics relieve mucous enteritis, expectorants bronchitis, and diuretics nephritis. It is not merely the watery parts of the blood that are thus evacuated, but its animalized constituents also, though the red corpuscles seldom pass. Upon the whole, this mode of depletion is much less efficacious than bleeding, in the relief of plethora and vascular excitement. But, for the purpose of promoting the absorption of effused fluids, it is even more efficacious; as a much larger amount of liquid may be safely abstracted from the blood-vessels by increased secretion than by bleeding, and consequently a greater amount of absorption produced. Another advantage which it possesses is the elimination of noxious matters from the blood-vessels; and there is reason to believe that much good is often effected in this way.

The remedies most efficaciously employed with reference to depletion, upon this principle, are cathartics, diuretics, and diaphoretics. But all that increase secretion are occasionally useful, including expectorants, emmenagogues, sialagogues, errhines, epispastics, issues, and setons. It is upon this principle, in part, that the warm, hot, and vapour baths act usefully in certain inflammatory affections. In the application of these various remedies, there is much room for discrimination; some being better adapted to one condition, others to another, and some being positively injurious where others are highly useful. This, however, is not the place to discuss their properties; and the reader is referred for information to works on the materia medica. It may be proper to mention here, that such as are employed for the reduction of plethora or inflammatory excitement should be destitute of general stimulating properties, and that the most efficient are those which unite a sedative influence over the circulation with the power of increasing secretion. Such especially are the saline cathartics, and the antimonial diaphoretics and expectorants. A general rule applicable to all these medicines is, that, in cases of high vascular excitement, when the pulse is full and strong, and bleeding is otherwise indicated, they should be preceded by that remedy. Secretion is often checked by excess of excitement in the secreting organ, and favoured by a reduction of the excitement. Besides, medicines are not easily absorbed, when the blood-vessels are full to distension.

Indirect Depletion.—This is effected by whatever prevents the usual amount of solid organic material from entering the circulation. Emetics and cathartics act in this way, by discharging the partially digested food from the alimentary canal before it has entered the lacteals. But still more efficacious is a temporary abstinence from food, or a reduction of its quantity and quality. A few general remarks upon the subject of diet, as a method of indirect depletion, cannot be better introduced than in this place.

Low Diet.—Antiphlogistic Diet.—Abstinence.—Entire abstinence from food, though tolerated for a time, and a powerful antiphlogistic measure, becomes very injurious if too long persevered in. In a healthy state of digestion, it is indeed impracticable. But, even when the patient has no desire for food, it is very possible to carry abstinence too far. If the blood-vessels receive nothing from the alimentary canal, they draw upon the whole system for a supply, and the detritus of the tissues, conveyed into the circulation by the lymphatics, becomes a substitute for food. The blood is thus recruited by the most highly animalized products, and, instead of acquiring antiphlogistic properties, passes into the state most calculated to excite inflammation. It is always, therefore, safest, where the stomach will receive nutriment, even in cases of the highest excitement, to permit entire abstinence only for one or two days, and then to give food, inversely proportionate, in quality and quantity, to the grade of existing action. Three conditions are requisite in the substances employed as diet in inflammatory febrile affections; one that they should be feebly nutritive, the second that they should not be irritant by their insolubility or difficult digestion, and the third that they should not be stimulant to the system. In relation to the first condition, there should be a scale rising with the declining state of the excitement; in relation to the second, some relaxation is admissible as the stomach becomes less irritable; but, so long as a depletory course is called for, the third condition should be rigidly adhered to. The following is a hasty view of the different kinds of food which may enter into an antiphlogistic diet. The first and lowest in the scale consists of certain organic vegetable principles, which do not exist in the animal system, and must consequently undergo changes in the process of assimilation. They are the least nutritive of all articles of diet, are wholly destitute of stimulant properties, and, being readily soluble, are least apt to irritate the stomach. They are, moreover, easily isolated from other substances, and may, therefore, be given without injurious admixture. They answer precisely the requisitions for the diet adapted to the highest degree of febrile and inflammatory excitement. Such are the different varieties of gum, starch, and sugar. They are closely analogous in composition; all of them consisting of carbon, oxygen, and hydrogen, the two latter ingredients being in exactly neutralizing proportions, as in water. There is some difference in their blandness, gum standing at the head of the list in this respect, then starch, and lastly sugar. The blandest of course are best adapted to the highest state of gastric irritation. Gum arabic, infusion of slippery elm or sassafras pith, arrow-root, sago, tapioca, barley-water, rice-water, refined sugar, and uncrystallizable sugar or molasses, are examples of this set of substances. Vegetable jelly or pectin, existing in the juice of various fruits and roots, may be considered, in a dietetic point of view, as identical with gum. These substances should be administered in the state of solution, which may be more or less concentrated, according to the degree of nutrition required, but so that they may be conveniently used for drink. They may be given separately or combined, and may often, with great propriety, be flavoured by one of the milder vegetable acids. These acids undergo digestion, and are, probably, like the principles mentioned, slightly nutritive; while the possession of refrigerant properties admirably adapts them to inflammatory affections. They are occasionally, however, somewhat irritant to the stomach. They exist in fruits, and are usually employed in the form of the expressed juice, or infusion of these fruits, or in jellies or syrups made from them; as in lemonade, orangeade, infusion of tamarinds, apple-water, currant jelly or blackberry jelly diffused in water, &c. Patients may be allowed occasionally to suck the juice of sweet oranges, and the better sorts of grapes, which are often highly grateful.

The second kind of food consists of substances of the vegetable kingdom, supposed to be identical in composition with certain constituents of the human body, and, therefore, capable of entering into its constitution without change. These are albumen, gluten, and vegetable fixed oils. They are highly nutritive, but not stimulant, and are, therefore, well adapted for the support of the system, when the strength begins to decline, but a degree of excitement remains, requiring an antiphlogistic regimen. They are never used in an isolated state, but as they exist in nature, associated with the principles constituting the first class, namely, gum, starch, and sugar. They are found thus associated in the different grains. Gruel made of oatmeal or Indian corn, Indian mush, boiled rice, wheat bread in the shape of panada, toasted wheat bread, water-crackers, &c., are forms in which these substances may be used.

In nature, the two sets of nutritious substances above spoken of are very frequently mingled with an indigestible principle called lignin or woody fibre, which appears to answer the purpose of stimulating the peristaltic movement of the bowels, and thus to keep them regular. This frequently gives a fibrous and tenacious character to the substances in which it exists, rendering them difficult of solubility in the gastric juice, and therefore disposed to irritate a tender stomach. On this account, these articles are unfit for cases of febrile excitement in which the digestive organs are feeble; but, as they are in no degree stimulant to the system at large, they may be used in cases of mild or chronic inflammation, in which the system does not sympathize, and in which the digestive powers are not impaired. Such are the edible fruits, and the various garden vegetables.

Another kind of food consists of animal principles closely analogous with the albumen and gluten of vegetables, and like them very nutritious, with but little of the stimulant power. These are albumen, fibrin, and casein, which are all supposed to be modifications of one peculiar nitrogenous principle, denominated protein, from which they are thought to differ merely in containing very minute proportions of sulphur and phosphorus. An example of albumen is the white of egg; but it exists, also, in a coagulated state, in most of the varieties of solid animal food brought upon the table, in the cooking of which it becomes insoluble. Very analogous to it is the casein or coagulable part of milk. Fibrin is the basis of muscle, and therefore exists in meats. According to the chemists, these principles are absolutely identical with the similar principles of plants, the animal albumen with the vegetable, animal fibrin with vegetable gluten, and the casein of milk with a peculiar coagulable principle found in the seeds of leguminous plants, and therefore called legumin. But an observant practitioner must, I think, hesitate to admit this entire identity; as he has been accustomed to see, from the varieties of food containing the animal principles alluded to, different effects upon the system from those produced by the vegetable. To me, at least, milk and boiled meats, which consist chiefly of these principles, have always seemed more supporting, perhaps I might say more stimulant to the system than bread, or other food prepared from grains. There are few practitioners who would venture to allow a patient, with inflammation, to use the former as freely as the latter. But animal food, consisting of these principles, is certainly less stimulating than other kinds of food from the same kingdom, and is therefore better adapted to the treatment of inflammatory complaints. They may be considered as intermediate between the most nutritious vegetable and a full animal diet, and are adapted to cases in which some reduction of diet, but the least possible, is required. Milk has been mentioned as one of the varieties of this kind of food. The oily matter which it contains bears about the same practical relation to the vegetable oils as its casein does to vegetable albumen. It is one of the first articles of food which may be permitted, in rising from the lower to the higher grades of diet. Thoroughly boiled meats, from which the principles soluble in boiling water have been removed, while the fat has been melted out, consist almost entirely of albumen and fibrin, and may be placed very nearly in the same grade. Fish is also intermediate between vegetable and the more stimulating varieties of animal food. It must be obvious to every one that, to secure the effects of indirect depletion from these more nutritious articles of diet, it is necessary that they should be given in quantities less than are adapted to the healthy state.

There are other animal principles which are decidedly stimulant to the system, as well as highly nutritive, and therefore unfit constituents of a diet intended to be accessory to a depletory treatment. These will be alluded to under another head.

II. Repletion.—By this term is here meant an increase of the quantity of the blood in general, or of its solid animalized ingredients. The circumstances of disease under which this remedial process is desirable are the opposite of those requiring depletion; viz., general debility, a too scanty blood, and a condition of that fluid in which, though its bulk may be sufficient, there is an undue proportion of the watery ingredient. The means by which it may be accomplished are the free employment of a highly nutritious diet, and the use of remedies calculated to invigorate digestion and sanguification, such as moderate exercise, tonic and stimulant medicines, frictions, the cold bath, &c.

III. Dilution.—By this is meant the copious internal use of water whereby the liquids of the body are diluted, and rendered less excitant. The liquors of the stomach are first diluted, then the blood in consequence of the absorption of the water, and, lastly, the secretions, especially those of the skin and kidneys, in consequence of its passing out through these emunctories.

The therapeutical effect is to relieve irritation or inflammation of the surfaces with which the diluted fluid may be in contact, as the mucous membrane of the stomach, and that of the urinary passages, and to moderate general excitement by attenuating the blood.

IV. Stimulation.—Stimulation, as here understood, is the exaltation of any or all of the vital functions above the state in which they may happen to exist at the time when the stimulating measures are resorted to. The subject in all its details is exceedingly copious, and would require, for its full developement, much more space than can be allowed to it in this work. We must content ourselves with a very general view of it. There is a vast diversity in stimulation. It differs in direction, degree, duration, and character. Perhaps the most convenient primary division of it is into general and local; the former being felt, to a greater or less extent, throughout the body, the latter confined originally to a particular part or organ. A property common to all stimulation, which may therefore be mentioned here, is that it is followed, in the ordinary state of the system, by a degree of depression bearing some proportion to the previous excitement. There may be conditions of temporary prostration, in which stimulation may put the system in the power of resuming its ordinary grade of action, without subsequent depression; but these do not come within the general rule. The depression is consequent upon the temporary diminution of excitability, resulting from excessive action. If the stimulant influence be continued, it follows as a consequence of the diminished excitability, that more of the stimulant agent must be employed to produce the same effect, and the excitability is thus still further diminished; until, in the end, the system refuses entirely to respond to the ordinary healthy excitants, and morbid and often fatal debility results. This is an evil against which it is necessary to be ever on our guard, in the use of stimulant measures. Another, scarcely less important, is the production of inflammation by the excessive or repeated excitation to which the stimulated organ or system is exposed. These two cautions are applicable to every kind of stimulation.

1. *General Stimulation.*—It is barely possible that stimulation should be absolutely universal. In whatever degree the functions generally may be excited, there is almost always some one or more that remain quiescent, or become depressed. Stimulation may be considered general, when any one of the vital properties or functions belonging to all parts of the frame is exalted, as contractility, or nutrition; or when one of the systems which pervade the whole body is excited into increased action, as the circulatory or nervous. In such cases, the excitement is felt throughout the frame, though not in every function.

The lowest grade of general stimulation is that produced by astringents, which operate on the organic contractility, and produce a general condensation or shrinking of the tissues. Orifices are thus contracted, the flesh becomes firmer, and the pulse somewhat more tense. Therapeutically, excessive discharges whether secretory or hemorrhagic are checked, relaxed tissues invigorated, and the general strength promoted. But caution is requisite in the application of this principle. Discharges are often intended to relieve congestions or inflammations, which would be fixed by their suppression; and the contraction of tissue may be carried so far as to interfere with the function of a part, instead of adding to its strength.

Somewhat higher in the scale of stimulation is the action usually denominated tonic. This is a moderate increase of the vital functions generally, produced rather slowly, and lasting for a considerable time. It is of vast importance in the treatment of moderate or chronic debility, when excitability remains but little impaired. It is indicated in the suppurative and gangrenous stages of inflammation; in the advanced periods of febrile disease, when the strength begins to fail, and support is required to sustain life until the affection shall have run its course; in all complaints attended with feebleness of the vital actions, from poverty, or depravation of the blood, or the depressing nature, either of the cause, or of coincident morbid influences; in the weakness from enfeebled digestion or exhausting discharges; and, finally, in the debility of convalescence. Among the agents by which tonic stimulation is effected is a class of medicines denominated tonics, which may act directly upon the whole system, or especially upon the digestive function, thereby enriching the blood, and making that fluid the immediate excitant. Some medicines are supposed to give tonic power to the blood by a direct action upon that fluid. Such are the chalybeates. There are other important agents, besides medicines. The cold bath, or a temporary exposure to cold air, in consequence of the reaction which follows its first depressing effect is highly corroborant; and the use of ice internally, taken in small pieces, and swallowed very slowly, has also been highly recommended in low diseases, with the same view; but these agents are obviously inapplicable to cases in which the system is so far debilitated as to be unable to react efficiently. A wholesome and nourishing diet, succeeding an impoverished one, and pure fresh air to those who have been confined to a close and vitiated atmosphere, have a powerful tonic influence. So also has moderate physical exercise, under similar circumstances of previous deprivation. Mental influences, moreover, have great effect. No tonic is, under many circumstances, more efficient than the cheering influences of social pleasures, domestic enjoyment, and a gentle exercise of the intellectual faculties, and all the kindlier emotions.

A quicker and more rapid stimulation is sometimes distinguished by the name of *diffusible*. It usually affects more or less the functions of organic and of animal life, though, as proceeding from one cause, it may be more especially felt in the circulation and its dependent functions, from another, in the nervous system. Remedies calculated to increase the vigour of the circulation, and augment animal temperature, without any peculiar or direct influence on the brain or nerves, may be called *arterial stimulants*. They are adapted to cases of considerable debility, in which active stimulation is indicated; and are peculiarly applicable when, in such cases, there may exist any strong tendency to cerebral congestion or inflammation, as in the great prostration which sometimes precedes febrile disease, or threatens death in concussion of the brain.

Stimulants which act chiefly upon the nervous system, may diffuse an apparently equable action over the whole of that system, or may concentrate their influence especially upon the brain. The former may be called *nervous stimulants*, though more commonly known by the name of *antispasmodics*. The latter I would propose to denominate *cerebral stimulants*, in preference to the name of *narcotics*, which implies simply their stupefying property, and belongs also to medicines of very different powers. The nervous stimulants are indicated in all cases of nervous disorder attended with debility; such as spasm, wakefulness, general uneasiness, jactitation, mental depression, &c. Their mode of operation in restoring the nervous functions to their due state is not exactly understood. They prove efficient not only in cases of debility, but in those, also, in which the nervous system is disturbed without any depreciation of the general strength, provided there be no vascular irritation or inflammation at the foundation of the disturbance. They may be said to act by equalizing the nervous excitement; but this explanation is too vague to be altogether satisfactory. Among the most efficient of them are musk, assafetida, and valerian.

The *cerebral stimulants*, operating more extensively and powerfully upon the system, are more efficient than either of the other classes in cases of deep debility, which call for all the resources of our art to support the failing strength, as in the low states of typhous disease. It is only in such cases as may be complicated with great cerebral congestion or inflammation, that they are contraindicated. Among medicines of this class, I rank alcohol, ether, opium, and camphor. In the use of all these stimulants, it must be remembered that the system sometimes puts on the appearance of debility, when in fact there is a general sthenic condition, and possibly a severe inflammation of some vital organ; and that a mistake, under these circumstances, might prove fatal. Instead of stimulation, depletion is often strongly indicated. Such are the cases in which the circulation fails in consequence of overpowering active congestion or inflammation of the brain, heart, or lungs; these organs being incapacitated from performing their functions, and the dependent functions ceasing of course. The excessive nausea which sometimes attends acute mucous gastritis, may have the same apparent effect by prostrating the circulation.

Heat may often be very advantageously resorted to in reference to its stimulating property. It may be applied by means of heated substances, such as heated bricks wrapped in flannel, bottles of hot water, bags of heated sand, oats, &c., or more generally by means of the hot air or vapour bath, or of the *hot-water bath*, the temperature of which may vary from 98° to 110°, according to the effect to be produced. In the use, however, of this agent, the tendency to subsequent depression, both by exhausting perspiration, and by the relaxation which follows excitement, must be borne in mind.

A quick and powerful, but transient stimulation is often indicated in cases of great and sudden depression. The object is momentarily to rouse the system, after which, its own unimpaired energies will be sufficient for its support. A longer continued impression might be injurious, by adding to the subsequent reaction. Syncope and the prostration from certain poisons are examples of this kind; and the effect may often be advantageously produced by the sudden application of cold, as, for example, by cold water dashed upon the surface. The shock acts as a powerful temporary stimulus to the nervous system. (See *page* 144.) Ammoniacal remedies, applied to the nostrils, act in the same way. Sometimes the excitement of strong emotion, when consciousness remains, produces a similar effect. Electro-magnetism is also a most powerful agent, under these circumstances.

Certain general stimulants have a determination to particular functions. Thus, mercury and iodine, which are moderate excitants of the system at large, are thought to have the peculiar property of stimulating the absorbents, and hence are employed for the resolution of chronic and indolent swellings. Nux vomica, along with a tonic power, has the property of stimulating especially the motor nerves, and hence answers sometimes admirably as a remedy in functional palsy.

Stimulating Food.—This may be the proper place to say a few words upon the subject of stimulating food. It has already been stated that the most nutritious substances are vegetable and animal products containing albumen, gluten, or fibrin, and casein, to which oil may be added. These may no doubt prove stimulant, if in excess, by enriching and augmenting the blood; but, if oil be excepted, they are not directly so, or at least in a very slight degree. Yet many animal substances, taken into the stomach, are directly and even powerfully stimulant. All persons of excitable systems have experienced this effect after eating freely of beef, pork, &c., even before these substances could have been converted into blood. They appear to operate by a primary stimulant impression upon the alimentary canal. But their effect is continued after digestion, probably from the more highly stimulant character they impart to the blood. Certain substances extracted by water from animal products have this character. Such probably is osmazome, or animal extractive. Such, moreover, may be gelatin, though its claim to be considered stimulating might be contested. Every one is familiar with the fact, that roasted or broiled meats are more stimulating than the boiled. This may be partly owing to some change which the proximate principles undergo, through the greater heat to which the former are exposed; but it is probably ascribable, in chief, to the more stimulant character of the principles extracted by boiling. This is strongly exemplified in the highly stimulating property of the preparation, sometimes made from beef and mutton, under the name of *essence*. The muscle, deprived of fat, is cut up finely, and introduced, without water, into a narrow-necked bottle, which, after being loosely corked, is exposed for an hour or more to a boiling heat in a pot of water, in which it is so placed that the top of the bottle is above the surface of the liquid in the pot. At the end of the process, the liquor which may have formed in the bottle is poured off, and constitutes the preparation in question. It is a concentrated solution of the soluble principles of the meat, is powerfully stimulant, and, in the quantity of from a teaspoonful to a tablespoonful, repeated at intervals of half an hour, an hour, or two hours, aids greatly in the support of the system in low forms of disease. Animal fat appears also to have a stimulant character. Hence, fat pork is an excellent diet for those who labour severely, and appear to require a strong impression upon their digestive organs, and a very rich blood. Hence, too, the blubber of seals is much valued as an article of food among the Esquimaux and other inhabitants of the frozen latitudes. The kinds of food in ordinary use to which the stimulating character especially belongs, are roasted, broiled, or fried pork, beef, and mutton, and, among poultry, goose, duck, and turkey. The dark flesh of fowls is probably more stimulating than the white; that of tame animals, than wild of the same kind; and that of the full-grown, than the young. May it not be, that the more stimulating kinds of animal food owe their influence, at least in part, to the production of a greater proportion of the red corpuscles, which are probably the most excitant portion of the blood?

Local Stimulation.—Local stimulation may have the effect of merely irritating or inflaming a part, or of exciting it to an increased performance of its peculiar function. In the former case, the object is usually to act revulsively, or to produce general stimulation by the sympathy of the system with the part affected. The agents employed for either purpose, so far as the external surface is concerned, are the rubefacients, epispastics, and escharotics. Occasionally, however, the object is entirely local. The vessels of a part may become relaxed and congested with blood, and, in consequence, an imperfect sort of inflammation may be sustained; or there may be ulceration, and the surface too feeble to take on the action necessary for the healing process. In either case, local stimulation sometimes answers an excellent purpose in removing the evil.

But still more frequently, this remedial process is employed for the increase of function. The surface may be pale, dry, and inactive; the muscles may be enfeebled to paralysis; the senses of smell, taste, and touch may be imperfect from weakness; digestion may be feeble, and the bowels costive from deficient secretion, or want of due peristaltic movement; the liver, kidneys, or other secretory glands may be inert. The means used to restore the weakened functions are medicines and other remedies having a special influence over the functions severally. Hence the use of friction to the surface; the hot bath; the cold bath used with a view to reaction; diaphoretics; errhines; masticatories; gastric stimulants, such as bitters, aromatics, and the mineral acids; emetics;

cathartics; diuretics; expectorants; emmenagogues; and cholagogues to excite the liver, as mercury and nitromuriatic acid. Hence the employment of ergot to stimulate the uterus to contraction.

Sometimes a local stimulant is employed to produce general depression; as in the case of the hydragogue cathartics, which, though they stimulate the bowels, depress the system in consequence of the depletion they produce.

V. Sedation, or Depression.—This implies a diminution of action. Like stimulation it may be general or local. *General sedation* may affect especially either the circulation and its dependent functions, or the nervous system. The agents which produce the former effect, I denominate *arterial sedatives*. They are the refrigerants of other writers, as they reduce temperature along with vascular action. They are indicated in excited states of the circulation, and morbidly increased temperature, especially when the condition of the system is sthenic; though some of the milder of them may be employed even in general debility, provided there is a frequent pulse, and a hot dry skin. The most powerful are probably the antimonials, which are often very efficient in inflammation and fever. The neutral alkaline salts, such as nitre and citrate of potassa, and the vegetable acids, as the citric and tartaric, have in some degree the same effect. Cold internally and externally is also powerfully sedative. It is usually employed in connexion with water or ice. But its strong tendency to be followed by reaction should never be forgotten in these cases. Water alone is also powerfully sedative. It has this effect whether taken internally or applied to the surface. In order to obtain its purely sedative and relaxing effect, when externally employed, it should be in the form of a bath, and of a lukewarm temperature, in other words, neither so hot nor cold as to add the effects of temperature to that of the water.* This has the advantage over the cold bath that it does not produce reaction. Most depletory remedies are sedative; but of these sufficient has been said already. The agents which directly reduce the actions of the nervous system may be called *nervous sedatives*. They may act in two modes; first, by a direct depressing influence upon the whole nervous system, and, secondly, by so affecting the nervous centres as to render them incapable of duly receiving and transmitting impressions. Those which act in the first mode are directly and essentially sedative; those which act in the second mode may, on the contrary, be even stimulant to the nervous centre, and by the very excess of stimulation, may incapacitate that centre from the performance of its duty. Now there is a great practical difference in the application of these agents. While the direct sedatives may be employed in cases of nervous excitement, with little reference to any supposed tendency to cerebral disease; those which produce their effect through excitement and consequent congestion of the brain, are the last remedies which would be thought of, when that organ may be deemed in danger. Thus, hydrocyanic acid, digitalis, tobacco, and acetate of lead may be employed, where it might not be safe to use alcohol or opium.

Local sedation may affect the whole of the tissues of a part, or more especially the nervous. In the former relation, it is employed to repress inflammation, or vascular irritation as shown in morbid secretion, hemorrhage, or simply congestion. The agents are chiefly cold, moisture, and the preparations of lead. Cold, to produce its due effect, must be employed steadily, in order to prevent reaction, which might increase the disease. It is usually applied by means of cold water or ice; though the evaporation of ether or officinal alcohol has in some degree the same effect. To obtain the legitimate relaxing effect of moisture, it must be neither hot nor cold. It is best applied in the form of emollient cataplasms, which are admirable remedies even in internal inflammations, when made to cover the external surface corresponding to the part affected. As in the case of leeches, some authors ascribe the antiphlogistic operation of cataplasms, under these circumstances, to revulsion or derivation. How then should they produce the same effect when applied directly to the inflamed surface, as they are known to do? May not sympathies, connecting the outer with the corresponding inner portions of the body, have something to do with the result? The preparations of lead are much used locally as sedatives, in inflammation of the skin and subcutaneous cellular tissue. They are best employed in solution, and, by reducing the temperature of the solution, the conjoint effects of the medicine and of cold may be obtained. Local nervous sedation is very useful in neuralgic pains and spasms. The substances employed belong to the narcotics. Opium, camphor, belladonna, stramonium, hyoscyamus, conium, and tobacco are among them. There is also another set of substances which have considerable effect locally in obtunding pain, by producing a partial paralysis of the part. Such are aconite and veratria, to which chloroform may be added.

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* The temperature of the *warm-bath* should be about 90° or from that to 95°. Above the latter degree, it might become somewhat stimulating through its heat.

VI. Revulsion.—Derivation.—Counter-irritation.—*Revulsion* consists in the diversion of disease from one part of the system, by the production of inflammation, or irritation, in another part. The term *derivation* may extend also to cases in which the diversion is effected by a degree of excitement, which may still be within the limits of health. *Counter-irritation,* strictly defined, applies to the revulsive impression, rather than to the revulsion itself. There is, in the human system, only a certain capacity of nervous action, and a certain amount of blood. When either the former or the latter is strongly directed to a particular part of the body, there is a tendency to its diminution elsewhere. This is absolutely necessary of the blood, and it is true to a great extent in relation to nervous action. Such a direction is given by the application of irritants of any kind. Hence, in order to relieve inflammation, any of the forms of vascular irritation, or mere nervous disorder, as indicated by pain or spasm, in any particular part of the body, we apply irritants, which, under these circumstances, are called revulsives, to some other part. This principle is of very extensive applicability in the cure of disease. It often comes into play as an auxiliary force, in cases in which the remedy is used for other purposes. Thus, while emetics are employed to relieve spasmodic affections of the air-passages, in consequence of the relaxation they produce, they are probably also useful by a revulsive influence towards the stomach. Cathartics act very powerfully upon this principle in the relief of inflammations and congestions, though they may be employed chiefly in reference to their depleting power. There is no remedy whatever, allowing it to have the power of producing excitement in any part of the body, which may not act as a revulsive. But the remedies usually employed, in especial reference to this principle of action, are external irritants, such as hot water, rubefacients, epispastics, and caustics. Derivation may often be advantageously effected by exercise, calling off undue excitement from internal organs to the exterior, or from one part of the body to another, and thus producing an equilibrium of the vital actions.

The application of the principle of revulsion requires discrimination. When the local affection consists rather in a determination of blood to the part affected than in inflammation, as in cases of vertigo threatening apoplexy, and of frequently recurring epistaxis or hæmoptysis, the indication is to divert the general current of excitement and of the blood to the most distant part of the body. Hence the use of strongly stimulating pediluvia, and of sinapisms to the legs, in cases of cerebral affection of the character just alluded to. But, when the disease is fixed in a part in the form of inflammation, it is necessary to bring the revulsive impression into nearer contiguity with the diseased part, though it may be proper also to employ remote revulsion as an adjuvant. Hence, in inflammation of the lining membrane, or of the contents of the great cavities, the revulsive remedy is most advantageously applied over the outer surface of the parietes of these cavities, as over the abdomen in cases of peritonitis or enteritis, the chest in cases of pleurisy or pneumonia, and the scalp in those of encephalic inflammation.

The revulsive influence of remedies is peculiarly indicated in cases of metastasis, or of diseases which are especially liable to assume the metastatic form. In these cases, the agent should be applied to a portion of the body towards which there is a natural tendency of the morbid action to flow, and in which it would be safe; as, in gouty cases, to the feet, and, in cases of retrocedent eruption, to the part of the surface from which the retrocession has taken place.

Another important principle is, not to employ a highly irritant revulsive agent in inflammatory cases, during the greatest violence of the disease. A strong impression upon the surface may sometimes prove useful in a commencing inflammation, before any febrile action has been excited, and in the declining stages, when the fever has in some measure yielded to depletion, or subsided spontaneously. But, during the existence of high constitutional excitement, the revulsive agent is not sufficient to unseat the inflammation, and, if of itself very irritant, as in the instances of the more powerful rubefacients and of blisters, may add to the existing excitement, by the sympathy of the system with the superficial inflammation they produce. But, when the revulsive impression is conjoined with copious depletion, as in the case of the saline hydragogue cathartics, which produce a revulsion towards the whole lining membrane of the bowels, while they evacuate the contents of the blood-vessels, it may be resorted to even in the greatest height of the inflammation. The copious secretion prevents a degree of irritation in the bowels, sufficient to bring the constitution into sympathy.*

When the local affection to be remedied is a mere nervous irritation, such as spasm or neuralgic pain, it is generally best to produce a quick, powerful, and transient revulsion; when inflammatory, especially when the inflammation is severe, to sustain a more moderate impression for a longer time. Hence, the more active rubefacients, such as mustard and ammonia, are applicable in the former case, and epispastics in the latter.

VII. Supersession.†—By this process is meant the displacing or prevention of one affection by the establishment of another in the seat of it. It is a general, though by no means universal pathological law, that two powerful diseases cannot exist in the whole system, or any portion of it, at the same time. If, therefore, we can produce a new disease, in the exact position of one that may be existing or expected, we may possibly supersede the latter; and, if the new disease subside spontaneously without injury, we cure our patient. The operation of numerous remedial agents is explained in this way.

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* Of course, in the cases here referred to, it is taken for granted that there is no inflammation or undue excitement in the alimentary canal itself; as, under such circumstances, any counter-irritant or revulsive impression made upon the stomach and bowels would be contraindicated.

† The author has taken the liberty to employ this word, because he could not find another exactly expressive of the same meaning; and the same excuse must serve him for having ventured to give a new meaning to the term *repletion*, employed in a preceding page.

It is thus, for instance, that mercury is supposed to cure syphilis. But we have better examples in the powerful influence of certain anti-periodic remedies, such as quinia and arsenic, in the cure of intermittent diseases. They establish their own morbid impression, in the absence of the paroxysm; and the system, being thus occupied at the moment when the disease was to return, is incapable of admitting it. In the same way may be explained the effects of blisters, opiates, emetics, or, indeed, any violent impression from any source, in the cure of paroxysmal diseases, if caused to be in full action at the time for the expected recurrence of the paroxysm.

Mental influences are sometimes very powerful in the superseding not only of intermittent diseases, but of continued disease also, when of a merely functional character. The excitement attendant on any strong emotion may have this effect; and the pre-occupation of the nervous system resulting from a strong faith has often exhibited a wonderful influence.

The same law holds in cases of purely local disease. It is probable that many cutaneous eruptions, and diseases of the mucous membrane of the alimentary canal and urinary passages, yield, upon this principle of supersession, to certain applications made to them directly, or, in the case of urinary diseases, through the route of the circulation.

VIII. Alteration.—This name may be given to that operation of medicines by which they change existing morbid actions or states, without any observable effect upon the system. The medicines are usually called alteratives. They may produce their effects by changing the character of the blood, or the condition of the solids. Their precise mode of action is unknown, or at best conjectural. It will be perceived that the employment of the term is merely a convenient mode of classifying certain unintelligible results, which depend altogether for their acceptance upon the evidence of observation. In certain states of disease, we administer certain remedies without other observable effect than a cure. It is often very difficult, in such cases, to decide whether the result has proceeded from the remedy, or has happened in the ordinary course of the disease. It is at least highly probable that a great many medicines have acquired a credit as alteratives which was due exclusively to nature.

Among the most striking illustrations of this operation of medicines is that of mercury in the cure of inflammation. After due depletion, or when depletion is not indicated, no remedy has so powerful an antiphlogistic influence as mercury, urged to the point of affecting the system. Usually, its action is evinced by soreness of the gums and some excitement of the circulation; but there is reason to believe that these have nothing to do with the therapeutic result, which indeed often takes place when they are not observed. The action of the remedy is therefore alterative. Other examples are afforded by iodine in scrofula, sarsaparilla in venereal disease, colchicum in rheumatism, &c.

It is apparent that supersession and alteration may often lay claim to the same results. Thus, does mercury cure syphilis and inflammation by the substitution of its own transitory morbid effects for the existing disease, or does it merely alter the morbid into healthy actions? Upon the solution of this question it depends, whether the remedy is to be looked upon as a supersedent or an alterative.

IX. Elimination.—It is now generally if not universally admitted that noxious substances sometimes exist in the blood, or in the tissues, or both, which cause, sustain, or aggravate disease. To separate these from the system is an important indication; and the process of elimination by which this end is effected must rank among the methods of treatment. The agents of this process are either such as, by stimulating the secretions, cause the separation from the blood of the offending matter, or such as exert an influence on noxious substances deposited in or incorporated with the tissues, so far changing their condition as to enable them to be carried into the blood and thrown off by the different emunctories. The former agents have already been considered under the head of depletion. They are the cathartics, diaphoretics, diuretics, &c. The latter are included among those which operate chemically, and therefore belong to the next division. It is only necessary here to call attention to this, as a distinct principle of therapeutics.

X. Chemical Influence.—Substances may be employed therapeutically, in reference to their chemical influence, for three purposes; first, for the destruction of the tissues, as in the formation of issues, the removal of morbid ulcerated surfaces, &c.; secondly, for the neutralization of substances contained within the body, but not forming an essential part of it, as of an excess of acid in the primæ viæ, the blood, or the urinary secretion; and, thirdly, for the production of such a change in noxious bodies existing in the tissues, and not removable by the ordinary powers of the system, as will enable them to be unseated, and discharged, as when iodide of potassium causes the elimination of lead and possibly of mercury from the system. It is not impossible that certain substances, taken internally, may produce curative effects through chemical reactions with the vital constituents of the blood, or of the tissues; but too little is known of the subject to justify any positive statements. It is well known that nitrate of silver has a powerful influence in subduing inflammation, whether of the mucous or cutaneous surfaces, when brought into direct contact with the inflamed part. It is also well known that a chemical action takes place between it and the surface to which it is applied. But how far these two facts are connected has not been determined.

XI. Mechanical Influence.—This is often very important in the treatment of diseases. *Position* may be made either to favour or counteract, through the agency of gravitation, the entrance of blood into a part. Thus, when fainting is threatened from a want of the due pressure of the blood upon the brain, by placing the patient in a horizontal posture, the pressure is favoured, and the apprehended result prevented. Much more frequently, however, the object is to diminish congestion or inflammation in a part, by diminishing the access of blood; and this is accomplished by elevating the part affected above its usual position. Thus, in an inflamed limb, the extremity should be raised, instead of being allowed to retain its ordinary dependent position of health.

Compression is another useful mechanical process, which may be made to diminish or increase the quantity of blood in a particular part of the body. Thus, the access of blood to a part may be lessened or cut off by pressure upon the arterial trunks which supply it; or the capillaries themselves may be emptied by direct and equable pressure made upon them. In the latter mode, especially, much good is often done in chronic inflammation and passive congestion. An accumulation of blood may be produced by pressing upon the veins and not upon the arteries, as when the tourniquet is applied not very tightly. This process may sometimes be useful by abstracting temporarily a quantity of blood from the general circulation, without ultimately losing it. Other advantageous effects of compression are to promote absorption, and to afford mechanical support to relaxed parts, as in varicose veins of the legs, and to the abdomen after the operation of tapping.

Distension sometimes acts usefully by stimulating a part to increased action, as when large fluid injections are thrown up the bowels. It may, however, be carried so far as to produce paralysis of the muscular fibre, and thus prevent all contraction. This is an important therapeutical fact.

Friction may be considered as a mechanical remedy. It acts partly by compressing the parts, partly by stimulating them. Employed for the latter effect, it is often a useful agent in rousing and supporting the system in low disease, and in exciting the part itself when enfeebled; but it is more frequently and beneficially employed for its effect in producing revulsion from within outwardly.

The *covering* of surfaces, so as to protect them against irritating substances, and the contact of the air, is another useful mechanical process. Thus, demulcents protect inflamed mucous surfaces; and collodion, cataplasms, plasters, and cerates are applied for the same purpose to the skin. It is not improbable that a part of the effect of nitrate of silver and iodine, in subverting superficial inflammations, may be owing to a chemical change in the epidermis, rendering it less pervious to the air.

PRACTICE OF MEDICINE.

PART II.

SPECIAL PATHOLOGY AND THERAPEUTICS.

Prefatory Remarks.

The object of this part of the work is to treat of diseases individually; and each will be considered separately in all its relations.

Diseases are certain associations or groups of morbid states or phenomena, offered by nature to the notice of the observer. If examined carefully, they will be found to consist of two different sets; one, embracing all cases in which the true pathological condition gives its name to the disease, the other, those in which certain prominent effects or phenomena are considered as the disease; the real morbid condition being kept in the back ground. As examples of the former may be adduced pleurisy, pneumonia, and gastritis, or inflammation severally of the pleura, lungs, and stomach; of the latter, diarrhœa, dropsy, and the hemorrhages, in which the title is derived from the secretion or effusion, in other words, from a mere effect of the proper pathological condition, from which the secretion or effusion proceeds. Some may object to the propriety of admitting the latter group into the list of diseases; but, as it is upon the effects alluded to that the attention is chiefly fixed, while the true pathological state may not be obvious, and may even be a subject of dispute, it will be most convenient to comply with the general custom; especially as, to the uninstructed, these phenomena will always constitute the several diseases, and names expressive of them will always hold their place in the common language. To the physician, however, it is important to look beyond the phenomena to their causes, and to fix his attention upon these as the true objects of his concern.

A vast amount of time and industry has been expended in the formation of systems of nosology. It is not the intention of the author to discuss their merits. Imperfect they all necessarily are; because diseases are not yet sufficiently understood to permit us, in all instances, to see clearly their mutual relations; and systems founded upon this basis must be constantly changing with new discoveries, and the adoption of new views. In this uncertainty, that plan of arrangement appears to the author to be the best, which is most convenient, and which may tend to direct the attention rather to what is positively known, than to the conjectures and peculiar opinions of authors. Such a plan is the one based upon the seat of the disease, and this it is here proposed to adopt.

Diseases will be placed together which are situated in the same parts; and no other attention, in the mere arrangement, will be paid to their mutual relations, than to form distinct groups, in each division, of such as may have the closest analogy. Upon comparing diseases, we find occasion to divide them into three great classes, having reference to their seat. The *first* class includes those diseases which occupy the whole system at the same time, and in which all the functions are simultaneously deranged. To the *second*, belong constitutional affections which may display themselves in local disease in any part or several parts of the system, but not in all at the same time. The *third* class embraces all the proper local diseases, or those which essentially affect some particular structure or function, and in which any general phenomena that may be presented are only secondary. This portion of the work will, accordingly, be distributed into three divisions, corresponding with the classes mentioned.

CLASS I.

GENERAL DISEASES.

The only diseases which belong strictly to this division are fevers. No other acute affections involve, like these, all the functions of the body; and if, in certain chronic affections, the system may become in some instances universally diseased, it is only in the advanced stages; and this universality is not, as in fevers, an essential part of their constitution.

It will be recollected that, in the essay upon fever, in the first part of this work, the distinction between the essential or idiopathic fevers, and the symptomatic was fully recognized. It is only of the former that I propose to treat in this place. Symptomatic fever is dependent solely on the local affection, owes all its importance to that affection, and ceases along with it. In fact it is the inflammation that constitutes the disease. The phlegmasiæ, therefore, as those diseases are called which consist of inflammation and consequent fever, are ranked along with the diseases of the organs in which they are severally seated.

Idiopathic fevers have been variously divided and subdivided, and have received a great diversity of names, according to the views of different writers. Thus we have *intermittent, remittent,* and *continued* fevers; *synocha,* or *inflammatory fever; typhous, asthenic,* or *adynamic fever;* and *synochous* or mixed fever, beginning as *synocha* and ending as *typhous.* To these, *congestive fever* has been recently added. But these diversities have reference merely to difference of form, grade, or type, and any one fever, that is, any febrile disease distinguished from others by the nature of its cause, may have all these different characters. Thus, the same fever, produced by the same cause, may be in different individuals, or in the same individual under different circumstances, either intermittent, remittent, or continued, inflammatory, typhous, synochous, or congestive. Again, many distinct fevers have been made out of accidental complications; such as *gastric, gastro-enteric, hepatic,* and *cerebral* fevers, so called in consequence of the predominance of disease in the several organs which gave origin to the names. This nomenclature, so far as it has been applied to idiopathic fevers generally, is incorrect; as it would seem to imply some essential difference between the diseases thus distinguished, whereas they may be absolutely the same disease, merely diversified by the occurrence of inflammation or irritation in one organ rather than in another. But, in very many instances, the diseases named as above have been nothing more than cases of phlegmasiæ, and would have been more properly entitled gastritis, gastro-enteritis, hepatitis, and encephalitis. It appears to me that, in the arrangement of fevers, we should endeavour to find out some essential difference between them, something which characterizes them as distinct diseases, peculiar in their phenomena and nature, and incapable of being converted into one another. Now such a basis of arrangement is offered in the peculiarity of the cause. Upon examining the various fevers considered essential or idiopathic, we find that, as a general rule, certain individuals are produced by one cause, others by another, others again by a third, and so on through almost the whole list; and we find, further, that those produced by one of these causes cannot be produced by another, each set requiring its own particular cause. Here, then, is an excellent, and, as it appears to me, quite unobjectionable ground of association. The cases produced by the same cause may very properly be treated as belonging to the same disease; and any incidental peculiarities of form, type, &c., should serve only as the ground of varieties. These different diseases have only one thing in common; namely, that all are attended with that proximate constituent of disease, called abstractly fever, or febrile movement. There is only one among them, in the arrangement of which, upon this plan, any great difficulty exists; and the difficulty, in this instance, arises from our ignorance of the cause. Nevertheless, in relation to that particular affection, there is so much to identify it in its phenomena, course, circumstances of occurrence, and anatomical characters, that we can scarcely deny its claims to individuality, though its cause is hidden, or at best obscure. The disease alluded to is that denominated variously, *continued* fever, *nervous* fever, *slow* or *protracted remittent*, *typhoid* fever, *typhus mitior*, *dothinenteritis*, &c., and which I propose to denominate *enteric fever*. It will be seen, also, that I place in one category all the cases of fever in which the causes, whatever their nature may be, act only as simple irritants.

Proceeding upon the plan above laid down, I shall treat of the following fevers, as distinct diseases, viz.:—

1. Irritative fever,
2. Miasmatic, or bilious fever,
3. Yellow fever,
4. Enteric, or typhoid fever,
5. Typhus fever,
6. Plague,
7. Smallpox, or variola,
8. Vaccine disease, or vaccina,
9. Chickenpox, or varicella,
10. Measles, or rubeola,
11. Scarlet fever, or scarlatina,
12. Erysipelas,
13. Glanders, or equinia, and
14. Dengue.

Of several of these there are varieties which require distinct notice, and some of them distinct designations. Thus, miasmatic or bilious fever is distinguished into intermittent and remittent, each of which may be mild or malignant, or to use a phraseology now in vogue, inflammatory or congestive. Of the fevers above mentioned some have circumstances in common which might serve to associate them in distinct subdivisions. Thus, some are propagated by contagion, and are hence called *contagious fevers;* some have the property, in common, that they are attended with an eruptive affection, and are denominated *eruptive* or *exanthematous fevers*. Now it happens that these are in many instances interchangeable terms; most contagious fevers being exanthematous, and most of the exanthemata contagious. But this is not universally the case. The contagious and exanthematous fevers are entirely distinct individually; for though they have certain points of similarity, each has its own peculiar traits, and its own peculiar cause.

Article I.

IRRITATIVE FEVER.

Under this term are included all cases of idiopathic fever resulting from causes of irritation, having nothing peculiar or specific in their mode of operation. The cause may or may not be sufficient to produce inflammation. All that is necessary in its action is, that it should induce an over-excitement of one or more of the functions, which, being propagated by nervous communication or otherwise to different parts of the system, may throw all the functions into a state of derangement, capable of sustaining itself for a longer or shorter time, after the direct action of the cause shall have ceased. The fever, then, does not depend, like the phlegmasiæ, upon the continuance of any local disease; but, having been once excited, goes on by an independent action to its regular termination. It is obvious that there must be a pre-existing disposition in the system to the febrile movement, in order that it should be thus independently sustained; seeing that a proper symptomatic fever, even though the local affection be much more violent than that which is necessary to the generation of idiopathic irritative fever, subsides immediately with the subsidence of the inflammation.

Symptoms.—Irritative fever begins with feelings of languor, weariness, &c., succeeded by a chill of longer or shorter duration, which gives way to febrile reaction, as described under the head of fever in general. Sometimes it begins abruptly with the chill, without the usual premonitory symptoms; and sometimes even the chill is dispensed with, though this event is comparatively rare. The degree of febrile reaction is exceedingly various. It may be so slight as scarcely to attract notice, or it may have all the violence of which the system is susceptible. There are usually a hot dry skin, frequent pulse, quickened breathing, furred tongue, headache, loss of appetite, thirst, constipation of the bowels, scanty urine, and diminution of the secretions generally. The pulse is sometimes very much increased in frequency, even more so than in most other fevers. It is often as high as 120 in the minute, and sometimes mounts to 130, 140, and, as has been asserted, even to 150 or 160. In most cases, however, it is considerably below the least of the numbers stated. It differs not less in strength and fulness than in frequency. Sometimes it is strong, full, and moderately accelerated, sometimes small and feeble; and the latter is most apt to be the case when the frequency is greatest. The blood, when drawn, is usually florid, coagulates rather speedily, and exhibits no appearance of the inflammatory crust. This is a point in which the affection differs strikingly from the phlegmasiæ, in which the buffy coat is generally found. There is occasionally slight inflammation associated with the fever, most frequently in the fauces, or some portion of the alimentary or pulmonary mucous membrane; but this is wholly insufficient to account for the symptoms, and is often wanting entirely. When present, it probably depends upon the same cause as the fever.

The duration of the fever is often not more than a day. In this case it is called *ephemera*. But it frequently continues for two, three, or four days, and sometimes it may run on to the seventh or tenth day. When thus prolonged, it is apt to become somewhat remittent, relaxing in the morning, and undergoing exacerbation in the afternoon or evening. The duration is altogether uncertain, and cannot be previously calculated. I have, in the evening, seen patients affected with violent fever, which had every appearance of a long continuance, and, upon repeating my visit in the morning, have found them almost or quite free from disease. Under proper treatment, the fever seldom lasts more than four or five days. If it run on beyond this period, it will generally be found to be associated with some inflammation which sustains it.

The decline of the fever is frequently attended with increase of the secretions. Perspiration is most common, and serves to mark the crisis of the disease, if it be not the cause of it. The urine which is passed at this period is apt to let fall a reddish sediment upon cooling. Occasionally the fever is carried off by a diarrhœa.

The grade of the disease is generally inflammatory; and the fever may often be considered as an example of the *synocha*, or pure inflammatory fever of Cullen. But occasionally the general actions of the system, though excited, have the taint of feebleness. A low fever somewhat of the typhous character is developed, though infinitely less dangerous than the genuine typhus. The previously debilitated condition of the patient, a depraved state of his blood from bad living, or exposure for some time to depressing influences, as of certain epidemics, exhalations from privies, &c., may account for this adynamic character.

In some instances, the disease appears to assume the intermittent form. At least, I do not know how otherwise to account for those cases of intermittent fever, which we sometimes meet with in situations beyond any suspicion of miasmata, and in individuals who, so far as can be ascertained, have never been exposed to their influence. Other diseases, as neuralgia, rheumatism, gout, &c., sometimes assume a regular periodical form, and why may not fever? If we suppose the constant operation of some irritant cause sufficient to excite a paroxysm of fever, when the system, in the course of its diurnal changes, is in a condition favourable for its action, but insufficient to resist the natural tendencies to a solution of the paroxysm, we have all the conditions requisite for the production of an intermittent fever. The disease, however, in this form, does not materially differ, in its symptoms or therapeutic indications, from the miasmatic intermittent, to which, therefore, the reader is referred. It will be sufficient to state, in this place, that the irritative intermittent is less apt to be complicated with bilious disorder than the miasmatic, and, as might be anticipated from the nature of the cause, is more apt to terminate spontaneously after a few paroxysms.

The infantile remittent of authors, so far as it is a distinct affection, is an example of simple irritative fever. Under that name, however, have been described several different diseases, resembling each other only in their febrile and remittent character, and in the circumstance of occurring in children. Gastritis, enteritis, mesenteric adenitis, hepatitis, tuberculous disease of the lungs and bowels, and especially enteric or typhoid fever, have been confounded under the vague title of infantile remittent. I believe that all the protracted or chronic cases of this disease, as described in the books, may be referred to one of the above affections, or some other of a similar character. Yet there can be no doubt, I think, that a remittent irritative fever, corresponding with the definition given, at the head of this article, does frequently occur in young children. The causes of its greater frequency with them, than with others, are probably the greater impressibility of their systems, and the more persistent character of the irritations to which they are exposed, such as teething, worms, and crudities of all kinds in the stomach and bowels. It is not to be understood that childhood gives anything peculiar to the nature of the disease. The fever may be and often is ephemeral, with children as with older persons; but it is more apt to be persistent in the former than the latter, and to continue on for several days in the remittent form. In this case, it exhibits usually more or less of the following character.

Children from two to eight years old are most subject to the complaint. Sometimes the fever approaches gradually, sometimes occurs quite abruptly in the midst of apparently excellent health. Indeed, the child is not unfrequently attacked after some unusual indulgence of his appetite. It is seldom that any other symptom of a chill is observed than some remaining coldness of the extremities, after the surface generally has become hot. This is perhaps owing to the circumstance, that the disease is not usually noticed until the fever has become established. When first visited, the child has a hot skin, a frequent pulse, sometimes amounting to 140 or even 160 in a minute, a furred and dryish tongue, quickened breathing, thirst, aversion for food, sometimes nausea and vomiting, and generally constipation of the bowels. There is also obvious disorder of the nervous system. If able to express himself, the child often complains of pain in the head; but otherwise, is restless and fretful, or if quiet, is heavy and disposed to sleep. Starting in sleep, and twitchings of the tendons are very frequent, and sometimes the onset of the fever is accompanied with convulsions. After a few hours, the violence of the symptoms abates; and on the following morning, the child is found with a cooler skin, a less frequent pulse, a moister mouth, less nervous disturbance, and a brighter and more lively expression. As the day advances, the fever again rises with similar symptoms as at first; and thus the disease continues, with daily remissions and exacerbations, till its close. In some cases, however, the remission is much less decided than in others; and occasionally it might be difficult to determine at what period in the twenty-four hours the febrile symptoms were most violent. Throughout the complaint, the tendency to constipation generally continues; and the passages, when procured, are apt to have an unhealthy appearance and odour, being clay-coloured, black, or greenish, with undigested food often intermingled, and very offensive. Occasionally there are large fecal accumulations in the bowels. The urine is scanty, and sometimes almost or quite suppressed. The breath is often sour, and of a peculiar heavy odour, characteristic of febrile disease in children. Delirium is not unfrequent; but still more frequently there is drowsiness, amounting sometimes even to stupor or coma, which is usually most striking during the exacerbations. Occasionally the child picks its nostrils and lips, so as to make them bleed; and in the advanced stages picks also at his clothing, or the bedclothes, or at whatever other object is near him, even at imaginary objects in the air; but this phenomenon is not confined to this form of fever, nor to children, though much more common, and a much less dangerous sign in them than in adults.

The disease runs on variously from five to ten days, or even two weeks; but, in the protracted cases, there is always reason to apprehend the existence of positive inflammation, generally within the abdomen, to which the complaint owes its continuance and danger. Unless in consequence of the supervention of inflammation, which places the disease among the phlegmasiæ, it almost always ends in recovery. The paroxysms generally become shorter and milder; purgative medicines operate more readily, and bring away more healthy discharges; the urine becomes more copious; the heat of skin and frequency of pulse abate; the tongue begins to clean, and the appetite to return; and health is gradually re-established.

It is not always easy to distinguish the true infantile remittent from the phlegmasiæ of the bowels. The occurrence of diarrhœa or of dysenteric stools, with a tumid abdomen and persistent tenderness upon pressure in certain parts, and less decided remissions in the fever, are the most prominent diagnostic symptoms of the latter affections. Some authors have attempted to distinguish between this and the worm fever. I believe that they are identical; worms being capable of exciting the fever in those predisposed to it, as well as any other irritant. The diagnosis between the infantile remittent and enteric or typhoid fever, will be better understood when the latter complaint has been studied. It will be sufficient to state, in this place, that, in the enteric fever, so far from a disposition to constipation, there is usually either diarrhœa, or a great facility of being acted on by cathartics, so that the least dose will often operate. There is, besides, more meteorism of the abdomen, a more regular march of the fever, and altogether a severer grade of disease than in the infantile remittent. The drowsiness or stupor which often attends the latter complaint may sometimes lead to the suspicion of cerebral disease; but the absence of violent screams and uncontrollable vomiting, in the earlier stages, and the ordinary circumstances that the stupor increases and diminishes with the fever, that the patient can be roused without much difficulty, and that there is no great derangement of the pupil, no strabismus, and no paralysis, will generally prove sufficiently diagnostic.

Causes.—These are very numerous. Whatever is capable of producing irritation in one or more of the important organs of the body may give rise to this kind of fever. The most frequent cause is probably exposure to cold. Persons who have been caught in a cold rain, and remain for some time with their damp clothes upon them, are apt to be attacked. General exposure seems more apt to induce irritative fever, partial exposure inflammation. In the former case, the disturbing influence is more widely diffused, and involves a greater number of functions, in the latter is more local. The moisture acts only by conveying away the heat more rapidly, and thus favouring the action of cold. This cause is always more efficient when it has been preceded by warmth, especially if attended with perspiration. Exposure to intense heat, or over-exertion in hot weather, may have the same effect. Errors of diet are frequent causes of irritative fever, and this is probably one reason of its greater frequency among the young. Teething and worms may be ranked among the causes. I have often witnessed fevers of this kind, lasting from one to four days, during the prevalence of febrile epidemics, as if the epidemic cause has been able to act as an irritant, though, from the previous protection of the individual, unable to produce its specific effects upon the system. Such was the case especially during the variolous epidemic which prevailed in Philadelphia in the winter of 1845–6.

But it is doubtful whether these causes would be sufficient to operate without the existence of a predisposition. In what the predisposition consists it is impossible to say with certainty. It is probably connected with an altered state of the blood, which may have an undue proportion of the red corpuscles, or be otherwise rendered more than usually stimulating. It is highly probable that this condition alone may, in some instances, be sufficient to induce an attack of fever, without the aid of any exciting cause whatever.

Age appears to have some influence. The young are more liable to the disease than the old, and persons below the age of maturity than those above. When blood is rapidly elaborated to supply the calls of a vigorous nutrition, anything which interrupts its regular expenditure may lead to plethora, and consequently to fever. In the old, moreover, irritability is much diminished, and irritant causes therefore less efficient.

Treatment.—In ordinary cases, this is very simple. In some instances, when the pulse is full and strong, the colour of the surface heightened, and much pain is felt in the head, or other signs of active cerebral congestion appear, it will be proper to take from twelve to sixteen ounces of blood from an adult; but this remedy is seldom necessary. Generally, an efficient cathartic, followed by refrigerant diaphoretics, will be sufficient, with a proper attention to regimen, to effect a cure. In the choice of the cathartic, the physician should be guided by circumstances. If he find nothing but febrile excitement, with or without a little redness of the fauces, he should prescribe sulphate of magnesia, or a combination of this with infusion of senna. Should symptoms of acid in the stomach be conjoined with the others, magnesia may be added to the saline cathartic. Should sallowness of the skin, yellowness of the tongue, or want of colour in the evacuations from the bowels, with oppression about the epigastrium, indicate hepatic congestion, and deficiency of hepatic secretion, the indication would be offered for some cathartic combination containing calomel; as three or four of the compound cathartic pills, a dose of calomel and jalap, or of calomel and compound extract of colocynth. The neutral mixture or effervescing draught, with or without small doses of tartar emetic, is usually the best diaphoretic, when the skin is hot and dry, and the pulse excited. Sometimes, however, when the action is of a feeble typhus-like character, or when a good deal of general soreness, as occasionally happens, is associated with the fever, ten grains of the powder of ipecacuanha and opium, given at bedtime, will prove highly useful. Should the fever continue, the bowels ought to be kept regularly open by the saline cathartics, and the diaphoretics above mentioned given in the interval. Rest should be enjoined, all causes of excitement avoided, the diet should be exclusively vegetable, and no stimulating drinks whatever allowed.

Should inflammation in any important organ be developed, sufficient to affect the system, the case must be treated exactly as an ordinary phlegmasia of that organ.

In the *infantile cases*, especially in the *infantile remittent*, some modification of the treatment is requisite. Some recommend an emetic at the commencement of the disease. This may be useful when the stomach is loaded with undigested food; but, as a general rule, is not advisable. Perhaps the most effectual remedy in the early stage is a full purgative dose of calomel. This cathartic appears to exercise a peculiar influence over the disease. It is certainly more efficient than other medicines belonging to the same class, which operate on the bowels no less powerfully. I have often seen the disease yield immediately to a full dose of calomel, after having been ineffectually treated with magnesia, castor oil, salts, &c. For more than thirty years, I have habitually used this medicine in the irritative fever of children, have never seen it do harm, and have very frequently found it to put an immediate end to the disease. I believe that, if given early, it will generally produce this effect, and thus prevent the protraction of the fever in the remittent form. How it operates is a matter of conjecture. Perhaps it may do good by its powerful influence upon the liver, promoting a free secretion of bile, and unloading the portal circulation. Perhaps it may have a peculiar alterative effect. But the fact of its utility rests not upon theory, but experience. In order to avoid the sore mouth which, in some fever cases of children, it is liable to produce when long retained in the bowels, care should always be taken to administer some other cathartic, if it fail to operate freely in six or eight hours. From two to six grains of calomel, according to the age of the patient, three or four grains being the proper dose for a child during the third and fourth year, may be given in syrup or molasses, and followed, if necessary, in the time above mentioned, by a dose of castor oil or sulphate of magnesia. Should the bowels not be well evacuated in this way, the operation of the cathartic should be promoted by enemata. In cases of obstinate constipation, moderate doses of infusion of senna, with manna, fennel seed, and sulphate of magnesia, repeated at intervals of two hours, will be found very effectual. After the bowels have been freely opened, should the fever continue, it may be treated with the neutral mixture, repeated every hour or two, in the dose of one or two fluidrachms, or, if the stomach be irritable, by a dose of the effervescing draught at the same interval. Along with the neutral mixture, when there is no sickness of stomach, small doses of antimonial wine, or of tartar emetic in aqueous solution may be used, the quantity being so regulated as not to induce vomiting or severe nausea. The spirit of nitric ether is also an admirable adjuvant, when there is much starting or twitching of the tendons. The warm bath is useful under similar circumstances. This treatment is especially applicable to the febrile paroxysm; but it may also be employed, with smaller doses, or longer intervals between them, during the remission.

Should convulsions have occurred or be threatened, in addition to the sweet spirit of nitre and the warm bath, as above recommended, poultices made with bruised garlic and flaxseed meal or bread and milk should be applied around the feet, and the back should be bathed, along the spine, with brandy heated with garlic. It may sometimes be proper to take blood from the arm, or by leeches from the temples, and to make cold applications to the head; but these are by no means necessary in all cases. The practitioner must be influenced by the degree of arterial action, and the evidences of sanguineous determination to the head. Convulsions in children are often the result of mere nervous disturbance, and do not require the lancet. When, however, they continue beyond a few minutes, or show a disposition to return, especially if there be no reason to suspect spasm in the intestines, it will be safest to take blood.

Throughout the disease, the bowels should be kept daily opened. Magnesia, alone, or combined with one of the saline cathartics, as sulphate of magnesia, tartrate of potassa and soda, or phosphate of soda, will often be useful, not only as a laxative, but also as an antacid. Should the patient be feeble, it may be given with rhubarb. Sometimes it may be proper to repeat the calomel, though in smaller doses than at first. It would be especially indicated by whiteness or blackness of the stools. Under the same circumstances, if the alimentary canal should be delicate, blue mass may be substituted for the calomel.

When the breath is sour, small doses of bicarbonate of soda or bicarbonate of potassa should be given, from four to six times a day, dissolved in water or carbonic acid water. The latter salt should be preferred when the urine is very scanty, in consequence of the diuretic properties of the saline compounds of potassa.

Should the abdomen be painful or tender, it should be covered with an emollient cataplasm; and sometimes leeches and blistering may be necessary. In cases accompanied with vomiting, teaspoonful doses of lime-water and milk, mixed in equal quantities, and given every hour, are often very serviceable. In the same cases, aromatic poultices, or weak sinapisms should be applied over the stomach; and it may become necessary to give an anodyne enema.

There is usually so much aversion to food that it is difficult to induce the child to take nourishment of any kind. This is an indication of nature which should not be slighted. In the early stages, very little food is required, and that of the lightest character. Solution of gum arabic, in the proportion of an ounce to a pint, is generally sufficiently nutritive for the first day or two, while the fever is high; and it has the advantage that, having little taste, the child will take it freely for drink, especially if it be made cold with a little ice. Barley, arrow-root, tapioca, sago, &c., may be given in liquid form, when something rather more nutritious is required; and rennet whey is a good article of diet under similar circumstances. Milk and water together with farinaceous substances, may be employed in small quantities as the disease advances, and at last, it may become necessary to support the strength by animal broth or jellies. Care, however, should always be taken to give nothing that can irritate the stomach or bowels. Cold water should be given frequently throughout the fever, and nothing is more grateful to the patient.

During convalescence, the bowels, if disposed to constipation, should be kept open by the mildest laxatives, or by enemata; and the greatest caution should be observed, in relation to the diet, not to allow indigestible articles of food, nor to permit too great an indulgence of the now sharpened appetite. On the other hand, if the patient is left feeble and without desire for food, and especially if he sweat copiously at night, it may be proper to administer the mineral acids, or simple bitters.

Article II.

MIASMATIC FEVER.

Under this name are included all the forms of fever resulting from the influence of marsh miasmata. For an account of the nature of this agent, as far as known, the circumstances of its production, the situations in which its effects are experienced, and the manner in which it operates, the reader is referred to the dissertation on the causes of disease in general. (See *page* 153.)

Of the different cases of fever which originate in this cause, some are *intermittent*, some *remittent*, and some so little variable in their course that they might, with as much propriety as almost any other instances of febrile disease, be considered as *continued*. But it is not in type or form only that these fevers differ. Some are characterized by a sthenic or vigorous grade of action, such as is usually denominated *inflammatory;* others have a low or typhoid tendency, especially towards their close; and others again are from the commencement decidedly *adynamic*, *asthenic*, or *malignant*. In the last section are included the cases now frequently denominated *congestive*. But all these varieties are essentially the same disease, modified by the degree of intensity in the cause, by the peculiar susceptibilities of the patient, or by some previous or coexisting morbid influence. They are in fact as much one disease as are the different varieties of smallpox, measles, or scarlet fever.

They exhibit this identity of nature, in the first place, by their interchangeable character. The intermittent, for example, sometimes becomes remittent, the remittent often ends in the intermittent, and those cases which may be considered as continued always, if of sufficient duration, exhibit a tendency to remit, and in the end sometimes to intermit. Indeed, the paroxysmal form appears to lie at the foundation of all of them; and, though it may sometimes be concealed by superadded phenomena, generally becomes evident upon a careful examination. Even the different grades show a disposition to run into one another. The inflammatory may become typhoid; and the lowest and most malignant cases often leave behind them a tendency, which, after the system has regained its energies, exhibits itself in the production of an intermittent or remittent of the ordinary kind. Again, in all the forms of miasmatic fever, there is a disposition to affect especially particular organs, as the spleen, liver, and stomach. All of them, moreover, occur at the same season, in the same situations, and even in the same family; one individual being affected, perhaps, with one form, a second with another form, and a third with still another. Thus, in the same family, there may be, in the same season, a case of ordinary intermittent, one of remittent, and one of malignant or congestive fever.

I shall treat of them under the divisions of 1. *intermittent fever;* 2. *remittent fever,* and 3. *pernicious, malignant,* or *congestive fever,* which may be either intermittent or remittent. As the cases which might deserve to be called continued exhibit, as before stated, during their course, if sufficiently protracted, a tendency to the remittent form, they may without impropriety be ranked in the second section. It will be understood that I do not include yellow fever among the miasmatic fevers. If resulting from a miasm at all, this disease is certainly not one of the effects of the ordinary marsh miasms.

All the varieties of miasmatic fever occur most frequently, and, as original affections, almost exclusively, in the latter part of the summer and in autumn. When they appear in the winter or spring, it is generally as returns of former attacks. Still, there are occasional cases of bilious fever, in its different forms, occurring in the latter seasons, without previous disease. In these, the tendency may be supposed to have lurked in the system, derived from exposure to the miasm during summer or autumn, and to become evident upon the application of some exciting cause; though it is not impossible that, in spring or early in summer, the heat may sometimes be sufficiently great, and sufficiently protracted, to cause the evolution of miasmata in a dilute, and comparatively inefficient form.

INTERMITTENT FEVER.

Syn.—Fever and Ague.

This disease is characterized by febrile paroxysms, recurring at stated times, and by the absence of fever between the paroxysms. The intervening period, from the end of one paroxysm to the commencement of the next, is called the *intermission* or *apyrexia;* the whole period occupied by one paroxysm, and the succeeding intermission, is called *the interval.*

The type of the fever has reference to the length of the interval. There are three ordinary types; the quotidian, tertian, and quartan. In the *quotidian,* the paroxysm recurs every day, with an interval of about twenty-four hours; in the *tertian,* every other day, with an interval of forty-eight hours; and in the *quartan,* every third day, with an interval of seventy-two hours. The inventors of the two latter names considered the two nearest paroxysmal days with the intervening day or days, as constituting one period, and thus counted every paroxysmal day twice in the succession. Other types are mentioned by authors; such as the *quintan, sextan, septan,* and *octan,* the last occurring at intervals of a week; but they are all very rare; and there are probably few physicians who have seen any one of them.

The regular types above mentioned are liable to numerous diversities. The *quotidian* is sometimes *double,* having two paroxysms every day. There is a *double tertian,* with a daily paroxysm, but occurring at different periods, or with different characters, on successive days; the paroxysms of alternate days exactly corresponding with each other. Thus, on the first and third day, the paroxysms may take place in the morning, and correspond with each other in grade and character; while on the second and fourth day, they shall occur in the afternoon, and in like manner correspond with each other, but differ from those of the two other days. It thus appears that two tertians are going on at the same time, but at different periods of the twenty-four hours. Sometimes there are two paroxysms in one day, and none in the next. This variety is distinguished by the name of *duplicated* or *doubled tertian.* The *triple tertian* has two paroxysms every other day, and one in the intervening day; that is, three instead of one in forty-eight hours. The *double quartan* is the variety in which, out of three days, two have each one paroxysm and the other none; the *triple quartan*, that in which there is a paroxysm every day, but the three successive paroxysms differ from each other, while they correspond respectively with the three which follow. Other varieties are mentioned by writers, as the *tripled* and *quadruple tertian*, the *doubled* and *tripled quartan*, &c. &c.; but these distinctions are mere refinements, of no practical value, and exceedingly rare in nature, if, indeed, they have any other foundation than in the imagination of observers. Of all the varieties above enumerated, the double tertian is the only one which often occurs. It is said that cases have been noticed, in which the paroxysms are altogether irregular. These are distinguished by the title of *erratic* intermittents.

SYMPTOMS.—Each paroxysm of an intermittent, when quite regular and fully formed, consists of three stages; viz., the *cold*, the *hot*, and the *sweating* stage, which usually succeed each other in the order mentioned. Very often, the paroxysm is preceded by the ordinary preliminary symptoms of fever, such as feelings of languor or weariness, general uneasiness, stretching, yawning, &c. (see *page* 87); and occasionally these feelings, with perhaps some pain in the head and back, impaired appetite, and a scarcely observable degree of febrile excitement, constitute the whole apparent disease for several successive paroxysms. A person is seized with the above symptoms, or something like them, which after a few hours pass off, almost without notice, and are perhaps quite forgotten, until upon their recurrence the next day, or the day after, or upon a third occasion at the same interval, and each time with increased severity, the patient is reminded of the preceding attacks, and finds himself, or is informed by his physician that he is labouring under intermittent fever. Attention to these imperfectly formed preliminary paroxysms is important; as the disease may be arrested by the adoption of proper measures at this early stage, and much subsequent inconvenience and discomfort spared the patient. Sometimes, however, the first regular paroxysm seizes the patient in the midst of apparently good health, and without warning.

Cold Stage.—After some yawning, stretching, &c., the patient experiences sensations of chilliness, especially in the limbs. These increase, and gradually spread over the whole body, becoming often severe and distressing. Not unfrequently, the chilliness seems to run in longitudinal lines, as if little streamlets of ice cold water were trickling down the trunk. Along with this, the patient experiences shivering or trembling; rapid and successive shudders run through the frame; the teeth often chatter, sometimes loudly; and the bedstead is occasionally shaken with the violence of the involuntary movements. These tremors, in connexion with the sensation of cold, are technically denominated *rigors.* The body often feels cold to an observer, especially the hands, feet, nose, ears, and cheek; but this is by no means uniformly the case. Sometimes the surface is hotter than in health, even when the patient experiences a feeling of severe cold.

In connexion with the sensation of coldness, the surface is pale and contracted, and not unfrequently presents the rough appearance known under the name of goose-flesh, which is owing to the projection of the sebaceous and capillary follicles, while the proper tissue of the skin shrinks. From the same cause, the hair sometimes bristles, as in fright. The hands are shrunken, the features contracted, the countenance pale, and the lips and ends of the fingers often purplish, or somewhat livid.

Though the tongue is pale and moist, there is often thirst; all disposition for food is lost; and occasionally nausea, and vomiting of food, mucus, or bilious matter, are experienced. The breathing is irregular, and often hurried; and the patient has a feeling of oppression or weight in the epigastrium or chest, which causes him to sigh deeply. There is sometimes also a short, dry cough. The pulse is small, in some instances quickened, even very much so, in others slow, often irregular and feeble. The secretions are generally scanty; but the urine is usually pale, limpid, and copious.

The nervous system is much disordered. Independently of the tremors already alluded to, there is often severe pain, of a neuralgic character, in the back, loins, and extremities, and sometimes in the head. The temper is not unfrequently irritable, and the mind confused, dejected, and sometimes even wandering. Occasionally there is drowsiness, which, in some rare instances deepens into stupor, coma, and even symptoms of apoplexy.

The duration of the cold stage varies greatly. Sometimes it does not exceed a few minutes, sometimes extends to three or four hours or more. On the average, it may perhaps be stated at about an hour.

Hot Stage.—Pyrexia.—The passage from the chill to the hot stage is not abrupt. Rigors for a time alternate with flushes of heat. The first sensations of warmth are rather agreeable than otherwise. A glow is felt about the face and temples, and the patient is conscious of increased heat of breath. Gradually the whole surface becomes hot; but even now, if a limb be moved into a cool part of the bed, sudden chills are felt, vibrating disagreeably through the frame. At length all traces of the cold stage disappear, and the patient is affected with a universal burning heat. The cheeks are flushed, the eyes sparkle, the surface is everywhere reddened, and the skin distended with blood. The evidence of increased heat is not confined to the sensations of the patient. The temperature of the body is positively increased. Fordyce found it to be 105° by the thermometer, and Mackintosh states that he has known it to be as high as 110° in Great Britain, and 112° in warm climates. The mouth is hot and dry; the tongue usually furred; and the patient generally complains of great thirst, though this is not invariable. There is an utter disinclination for food, and occasionally nausea and vomiting. The respiration is more regular than in the chill, but is still accelerated. The pulse is more frequent than in health, and is usually full and strong. In some cases, however, when the state of system is adynamic, it is at once frequent and feeble. All the secretions are diminished; the skin being dry as well as hot, and the urine scanty and often high-coloured. The head is almost always painful, sometimes very much so; and the suffering from this cause, as well as the general violence of the febrile reaction, is often greater than is usual in remittent or continued fever. The pain is frequently throbbing, with a feeling of distension in the temples, and seems to be deep in the head, unlike that of the chill, which is generally superficial. There is frequently also pain in the back and limbs. Convulsions are not uncommon in children, at the commencement of the hot stage. Sometimes there is a moderate delirium; but this is not common. In some instances, a rash-like, or a petechial eruption appears and disappears with the fever. The duration of the hot stage varies from two to eighteen hours or more, before it begins to abate.

Sweating Stage.—Perspiration generally appears first upon the face and breast, and gradually spreads over the surface. It is sometimes slight, but generally copious, and occasionally very profuse. Upon its first appearance, the patient begins to feel some relief; and the febrile symptoms gradually abate as it advances. The skin becomes cool, the excitement of the circulation subsides, the mouth is moistened, the headache disappears, and the patient frequently falls into a calm sleep, from which he awakes free from fever.

The kidneys now resume their function, and the urine which is discharged very often deposits a lateritious sediment upon cooling.

It has been stated by writers that each stage of the paroxysm, subsequent to the chill, is the immediate effect of the preceding stage, in other words, that the cold stage produces the hot, and the hot the sweating. But this is scarcely probable, at least with regard to the first two stages, which bear no proportion to each other; a protracted and severe chill being frequently followed by less fever than a very slight one, and the fever sometimes occurring without any preceding chill whatever. The probability is, that, while the depression of the cold stage is naturally followed by some degree of febrile reaction, as a necessary consequence, the morbific cause, whatever it may be, is capable of producing the hot stage by a direct influence.

The whole duration of the paroxysm varies greatly. In many instances, it does not exceed three or four hours; while in others it runs on to within a very short time of the succeeding paroxysm, lasting sometimes in a quotidian eighteen hours, in a tertian thirty-six, and in a quartan sixty. As a general rule, however, the paroxysm is longer in a quotidian than a tertian, and in this than a quartan. The average duration in the quotidian may perhaps be stated at ten or twelve hours, in the tertian at eight or ten, and in the quartan at five or six. But the paroxysms generally shorten, as the disease becomes of longer continuance.

The paroxysm is liable to other diversities. Sometimes the cold stage is very slight, and exhibits few of its characteristic symptoms. Cases are not uncommon in which the only discoverable signs are some blueness about the nails, and a little coolness of the nose, ears, hands, and feet. This is especially the case with young children. Occasionally, even these symptoms are wanting, and the paroxysm begins at once with the hot stage, without any preceding chill whatever. This is the form of the complaint called by the vulgar *dumb ague*, to distinguish it from the more common form, which is called *shaking ague*. Sometimes the sweating stage is wanting; the fever either gradually subsiding without any discharge, or the place of the perspiration being supplied by a diarrhœa, or a copious flow of urine. The idea has been advanced, and it seems plausible, that the dropsical effusion which occasionally attends an attack of intermittent fever, may be vicarious to the perspiration. It is asserted that the cold stage has, in some instances, passed into the sweating, without the intervention of febrile reaction; and that, in others, the whole paroxysm has consisted of perspiration without either chill or fever. But, in such cases, the disease, though it may be intermittent, can scarcely be said to merit the name of intermittent fever. In the double tertian, it sometimes happens that, of the two paroxysms, which serve as the prototypes of all the others, one may be regular in all its stages, while the other is destitute of chill, or in some other way peculiar.

Among the vagaries of the paroxysm, a very singular one has been noticed in which the affection is confined to a single limb, which passes through the several stages regularly, the remainder of the system being apparently undisturbed. Various affections, occurring at regular intervals, without any other resemblance to intermittent fever than their paroxysmal character, have been considered as *masked* cases of the disease (*febris intermittens larvata*). Among these may be enumerated neuralgia, rheumatism, epilepsy, hysteria, hiccough, petechial eruptions, diarrhœa, and dysentery, all of which occasionally appear in the intermittent form, occurring daily or every other day at the same hour, with intervals of apparent health. But it appears to me that they have as little claim to be considered intermittent fever, as the same affections, in their continuous form, would have to be considered continued fever. If they could be shown to be uniformly the result of miasmatic influence, there might be some foundation for this view of their nature; but the fact is, that they sometimes occur under circumstances in which miasmata could by no possibility have been the cause.

Intermission, or Apyrexia.—After the paroxysm has subsided, the patient, though without fever, is not usually quite free from signs of disease. General languor, facility of fatigue, pains in the back and loins, uneasy sensations in the head and epigastrium, with some fur upon the tongue, and a feeble appetite, are not unfrequently left behind, in greater or less degree. The patient, moreover, is apt to have a pale or somewhat sallow complexion, and a sickly look. These, or analogous symptoms, are most common after the early paroxysms. Sometimes they are very slight, sometimes so considerable as, in connexion with some heat of skin and frequency of pulse, to render the intermission imperfect. They generally diminish with the continuance of the disease; and at length the patient becomes apparently quite well in the intervals of his attacks; having, not unfrequently, the appetite, the digestion, and the general vigour, though not perhaps fully the aspect of health. To the above rule, however, there are exceptions. Cases occur in which the patient, even at the commencement, is as free from all signs of disease during the intermission, as in his most perfect health.

COURSE, TERMINATION, &c.—It has been stated that, in the several types of intermittent fever, the paroxysms return at the same hour of the day. There is, however, often some variation in this respect. The commencement of a paroxysm, instead of being precisely at the same time of day as that of the preceding, may be an hour or two earlier, or an hour or two later; and it not unfrequently happens that, if a little before the time upon one day, it is a little after it on the next, so that the mean between the extremes of divergence is the regular hour. In some cases, instead of thus fluctuating backwards and forwards, each succeeding paroxysm occurs an hour or two earlier than its predecessor, so that the length of the intermission is regularly diminished. In other cases, it occurs an hour or two later, so as regularly to lengthen the intermission. In the former, the disease is said to be an *anticipating*, in the latter, a *retarding intermittent*. One type may in this manner be converted into another. Thus, an anticipating quartan may become a tertian, and an anticipating tertian a quotidian; while a retarding quotidian is changed into a tertian, and a retarding tertian into a quartan. It is obvious that an anticipating quotidian may pass from the intermittent to the remittent form.

It is a remarkable fact, that the paroxysms seldom occur during the night. Perhaps sleep may in some way oppose a resistance to their attack. The rule is not universally, but generally true. In the vast majority of cases, the time of attack is between the hours of eight in the morning and eight in the evening; and it is worthy of observation that, in the anticipating and retarding cases, when the receding or advancing paroxysm reaches the period of darkness, it is apt either to be arrested in its course, or to leap over the night, backward into the evening, or forward into the morning. Thus, the paroxysm of an anticipating tertian, occurring first at noon, and recurring afterwards successively at the hours of ten, eight, and six, will, after attaining the last mentioned hour, either continue to recur at the same, or will return next time at about six or eight in the evening preceding the regular period. A retarding tertian, on the contrary, after reaching the confines of night makes its next attack in the morning, subsequent to the regular day of return. (*Fordyce.*)

It has been generally observed that, the shorter the intermission, the earlier is the hour of the day at which the paroxysm is disposed to appear. Thus, the quotidian most frequently makes its attack in the morning, the tertian about noon, and the quartan in the afternoon. It is true that there are very frequent exceptions to this rule. Thus, the quotidian and tertian may change places, or may either of them occur in the afternoon; but the paroxysm of the quartan very rarely appears in the morning. Another result of observation is, that the longer the duration of the disease, the later in the day are usually the returns. Hence, in old cases of intermittents, the paroxysms should occur in the afternoon.

Reference has been made to the change of one type into another in the course of an anticipating or retarding intermittent. But the same conversion sometimes takes place abruptly. The most common is from a type with frequent paroxysms, to another in which they are less frequent. Hence, a quotidian is more apt to become tertian, and a tertian quartan, than the reverse.

Intermittents, if left to themselves, will not in general run on indefinitely. The milder cases not unfrequently terminate spontaneously with the seventh or eighth, and sometimes so early even as the fourth or fifth paroxysm. More than one-half of the tertian fevers which occurred in the infirmaries of the *Salpêtrière* of Paris, in the autumn of the sixth year of the Republic, terminated with the ninth paroxysm, or previously. The treatment employed was of the simplest kind, and calculated to have little effect upon the course of the disease. (*Dict. de Méd.*, xvi. 589.) According to Fordyce, quotidians usually end spontaneously in about ten weeks, tertians in about four months, and quartans in six, seven, or eight months. But occasionally, these diseases continue for a much longer time, if not interrupted.

When an intermittent has been checked by any means whatever, it has a strong tendency to return, so that very slight causes will often provoke a fresh attack, and not unfrequently a recurrence will take place without any appreciable cause. Quartans are said to be most apt to relapse; but all the types are subject to the law. In these returns, there is a singular tendency to observe the septenary period. It has been said that quotidians are most apt to return at the end of a week, tertians of two weeks, and quartans of three. I have not noticed this peculiarity of the several types; but of the general fact there can be no doubt. In most instances, according to my own observation, the relapse takes place upon the fourteenth day from the occurrence of the last paroxysm; and, if this day be passed, then at the end of the third week, or at some future weekly period. An autumnal attack of intermittent is very frequently succeeded by another, at the opening of the warm weather, in the subsequent spring. The liability to the recurrence of the disease continues for one or two years, and sometimes much longer. In general, the subsequent attacks, without a fresh exposure to the cause, are milder than the original.

GRADES AND COMPLICATIONS.—Intermittent fever may be of a sthenic character, with a vigorous reaction, a full strong pulse, a florid surface, and a pure rich blood; it may be asthenic, with unusual depression in the chill, a slow and uncertain reaction, a feeble though frequent pulse, a dusky or purplish hue of the skin, and a depraved, impoverished, or scanty blood; or it may be of any grade between these two extremes. In the first mentioned form, it is sometimes though erroneously said to be *inflammatory;* for the condition may exist altogether independently of inflammation. In the second form, it may be called simply *feeble*, when the blood is not depraved, and the general energies not greatly depressed; *typhoid*, when along with the debility there is a peculiar contamination or depravation of the circulating fluid; and *malignant*, *pernicious*, or *congestive*, when the powers of the system are so much prostrated as to endanger a very speedy and fatal issue.

These differences depend, not on the peculiar character of the miasmatic cause, but upon the previous condition of the patient, or the influence of other causes acting conjointly with the miasmata. Most cases occurring in temperate latitudes have more or less of the sthenic grade; and the characters of this grade have been sufficiently detailed in the general description of fever. The merely feeble cases are known by a general deficiency of energy in the reaction, and the marks of debility in the intermission, without peculiar symptoms of derangement, or any very alarming signs of prostration. They are not uncommon among individuals reduced by previous indisposition. The typhoid cases may be recognized by the greater depression of the chill, the pungent heat of the skin during the reaction, the very frequent but comparatively small and feeble pulse, the more than ordinary dryness of the mouth, the brown colour of the tongue, the tendency to the production of sordes about the teeth, the dusky hue of the surface, and the greater frequency of nervous symptoms, as subsultus tendinum, jactitation, and low delirium. They are met with chiefly among persons previously exposed to the want of proper sustenance, fresh air, and the ordinary comforts of life, or at periods when an epidemic typhoid influence prevails in miasmatic districts. Of the malignant or pernicious intermittent I shall treat separately; as it differs from the other forms strikingly in some of its symptoms, and requires that especial attention should be called to it, in consequence of its terrible fatality when mistaken, and inefficiently treated.

Intermittent fever is not unfrequently associated with inflammation of an organ or organs of the body, and, in this state, has often been confounded with the higher grades of the ordinary sthenic form of the disease, under the name of inflammatory intermittent; the local affection having been overlooked or disregarded. The distinguishing general character of these complicated cases is the appearance of the buffy coat of the blood upon coagulation. Except in the pregnant state, and in anemic cases, which are in general readily recognized, this sign may be considered as conclusive of the existence of inflammation. When this attends the sthenic state of the fever, a peculiar hardness of the pulse is superadded to its strength of impulse. But the inflammation may also be coincident with the typhoid character of the disease, in which case this hardness may be wanting.

The organs most frequently affected are the stomach and bowels, the liver, the lungs, and the brain, or its investing membranes. To enumerate here all the symptoms characteristic of the phlegmasiæ of these structures, would be to anticipate what must be stated fully hereafter. It will be sufficient to notice a few prominent symptoms, which may serve to fix attention upon the inflammation when it shall exist. When the stomach is inflamed, there are usually burning pain and tenderness upon pressure in the epigastrium, a craving for ice or cold drinks, and a more than ordinary degree of nausea and vomiting; substances which are ordinarily acceptable to the stomach, being often promptly rejected. Inflammation of the bowels is manifested by colicky pains in the abdomen, more or less tenderness over some particular part of its surface, and diarrhœa, or dysenteric symptoms. The liver may be considered as the seat of inflammation, when there are pain and tenderness in the right hypochondrium, difficulty of lying on the left side, pain in the right shoulder, nausea and vomiting, discoloured evacuations from the bowels, yellowness of the skin, conjunctivæ, or tongue, and a deep-brown colour of the urine. These inflammations are most frequent in the summer and autumn. The symptoms of thoracic inflammation are different, according as the bronchial membrane, the parenchyma of the lungs, or the pleura, is affected. In the first case, the ordinary catarrhal symptoms are presented;

in the second, cough with a scanty, viscid, and rusty expectoration, and an obtuse pain in the chest; in the third, acute pain at some one point in the side. This complication is most frequent in winter and spring. Inflammation of the encephalon may be suspected, when the pain in the head is severe, the patient is painfully sensitive to light or sound, the pupil is contracted, and delirium or convulsions are conjoined with the other symptoms. All these inflammatory complications are most apt to occur in the young and vigorous. They are proportionably more frequent in the quotidian than the tertian, and in the tertian than the quartan. Old persons are most subject to attacks of apoplexy or paralysis.

The inflammation may be so severe as to keep up some febrile excitement, after the intermittent paroxysm has subsided. In this case a complete intermission is prevented. The disease at first presents the character of a remittent; but, as the inflammation diminishes, the inter-paroxysmal fever ceases, and the true character of the affection becomes manifest. When the inflammation is not of a grade or extent to sustain a symptomatic fever, the intermission may be complete so far as regards frequency of pulse and heat of skin; but a close examination will often detect signs of the local affection in tenderness of the organ affected, a furred tongue, defective appetite, and a certain degree of hardness or resistance in the pulse, not ordinarily observed in the apyrexia.

The inflammation which thus occasionally attends intermittent fever may have previously existed, or been called into action by the influence of the fever upon a predisposition, or may be coincident with the fever, and like it dependent immediately upon the miasmatic cause, or, finally, may be the result of exposure to some accidental cause in the progress of the disorder.

Authors sometimes speak of *gastric intermittents*, and *cerebral intermittents;* but there is no foundation for such distinctions. It is true that the stomach and brain are severally much more irritated in some cases than in others; but the same may be said of any one of the organs; and thus we should have subdivisions of the disease as numerous as the functions. The cases, denominated as above, generally owe whatever peculiarity they may evince to complications of the intermittent fever with gastro-hepatic inflammation, in the one case, and with some form of encephalitis in the other.

EFFECTS.—If an intermittent be speedily checked, it will leave no other unpleasant consequence behind it than a disposition to return. But, if allowed to run on indefinitely, or if frequently provoked to return by a continued exposure to the cause, it sometimes produces very disagreeable effects. The most common of these is *enlargement* of the spleen. Miasmata appear capable of producing disease in the spleen, liver, &c., by an immediate influence; and it is possible that affections of this kind, accompanying intermittents, may sometimes be the result of the same cause that gives rise to the fever; but it is very certain that they are frequently, and highly probable that they are much the most frequently occasioned by the intermittent paroxysms. Indeed, the spleen can often be perceived to be enlarged during the cold stage. The blood which leaves the capillaries becomes congested in the viscera, and especially in the spleen, which is probably intended as a diverticulum, to prevent injury from such irregularities of the circulation to more important organs. The enlargement subsides somewhat in the apyrexia, but, returning again in greater degree in the subsequent paroxysm, becomes at length, in some instances, excessive; so that the spleen may be perceived extending far into the abdomen, and occasionally occupying more than one-half of the cavity. It is generally also more or less indurated. In this state, it is commonly called *ague cake,* and is a well-known affection in miasmatic districts.

It is said to be most common in the quartan, and least so in the quotidian. The more obstinate and long continued the disease, the more apt it is to be attended with this affection of the spleen.

In like manner, the liver sometimes becomes enlarged and indurated; and, even when not sensibly increased in bulk, is often affected with chronic inflammation, or derangement of function, giving rise to jaundice, dyspepsia, diarrhœa, &c.

The appearance of a patient labouring under chronic intermittent is characteristic. His countenance has a sallow paleness, with frequently a sad or dejected expression, indicative of habitual depression of spirits. Feelings of languor, muscular weakness, and liability to fatigue upon slight exertion, are very common. The tongue is often furred, the appetite feeble, the discharges from the bowels clay-coloured or otherwise deranged, and the urine occasionally dark-brown as in jaundice. Sometimes the body is emaciated, sometimes rather full as if bloated.

A very frequent result of protracted intermittent is dropsy. This affection sometimes occurs during the continuance of the disease, and, as before stated, has been ascribed in part to a vicarious secretion into the cellular tissue and serous cavities. But it is more frequent after the intermittent has been interrupted. Even in such cases, it may possibly be owing, in part, to the substitution of a serous discharge for the perspiration to which the system was accustomed, and to which the process of sanguification had become accommodated; and a return of the paroxysms is sometimes followed by a disappearance of the dropsy. (*Nordamerik. Moratsbericht*, &c., i. 27.) I have often found the urine to be albuminous, and sometimes highly so. Yet the dropsy is generally curable. Hence it may be doubted whether the kidneys are, as has been supposed, organically diseased. Sometimes the urine is albuminous in intermittent fever, without any dropsical symptoms. (*Archives Générales*, *4e sér.*, xv. 509.) The probability is, that the watery condition of the blood so often an attendant or result of intermittents, is the main source of the effusion in these cases. Another source of dropsy in intermittents, is organic disease of the liver and spleen. The veins of the abdominal viscera, and sometimes of all that portion of the system drained by the branches of the ascending vena cava, become congested, in consequence of obstruction in the liver and spleen, and relieve themselves by effusion. This form of dropsy is often obstinate, and sometimes incurable; for, though relieved by remedies, it is apt to return so long as the cause continues. Yet, when the result of intermittents, it is much less hopeless than when springing from independent disease of the viscera; for there is always some prospect of removing it by eradicating the original affection.

An attack of insanity has been known occasionally to follow the cure of an intermittent. The latter disease is thought also to have been sometimes injurious by suspending menstruation, the lochial discharge, and the secretion of milk in women, and habitual hemorrhoidal discharges in men.

But, while thus fruitful in mischief, intermittents have the credit, probably in some measure deserved, of being occasionally useful, by superseding other diseases, and removing morbid tendencies which had before resisted treatment. They act in this way like medicines which substitute a safe and temporary, for an unsafe or obstinate affection. It is more especially, though not exclusively, nervous diseases that are thus remedied. Among them are neuralgic affections, epilepsy, hysteria, asthma, dyspepsia, rheumatism, and various cutaneous diseases. Even mania is said to have been superseded by intermittent fever, and the tendency to pulmonary consumption has been thought, though probably on insufficient grounds, to be materially counteracted by it.*

Anatomical Characters.—The proper anatomical character of intermittent fever has scarcely been ascertained. The lesions which have generally proved fatal, and which are those observed upon dissection, are not essentially parts of the fever, being sometimes purely incidental, and sometimes effects which might have been absent without affecting the integrity of the disease. Inflammation of the brain and of its membranes, cerebral congestion and effusion, gastritis, gastro-enteritis, pulmonary inflammation and congestion, and various diseases of the liver and spleen, are among the affections which have been most frequently observed in persons who have died while labouring under intermittent fever. The liver has usually been found congested with blood, and of a dark purple or black colour. Enlargement with or without change of structure, increased density, softening, and suppuration, are the lesions most frequently observed in that organ. The spleen has generally been found enlarged, and altered in texture, sometimes broken down and softened, so as even to resemble coagulated blood enveloped in a membranous covering. Occasionally it has been ruptured, and dark or grumous blood has been met with in the cavity of the peritoneum. Suppuration of the viscus has also been noticed.

Causes.—Of the intermittent fever here treated of, miasmata are the essential cause. Some have supposed that all cases of intermittent fever have the same origin. Experience, however, is opposed to this opinion. We every now and then meet with instances which can by no possibility be traced to miasmata. Indeed, cases sometimes occur which proceed obviously from some temporary irritation, such as the introduction of instruments into the urethra, indigestible food in the stomach, worms in the bowels, &c. The case of M. Brachet is interesting, as tending to show that habit may have the same effect. M. Brachet for seven successive nights, at midnight, bathed in the river Saone, towards the close of October, when the water was cold. Retiring to bed after each bath, and covering himself warmly, he was affected with considerable reaction, which terminated in perspiration. At the end of the seventh day, he omitted the practice, but was nevertheless nightly, about the same hour, attacked with a regular intermittent paroxysm, consisting of the cold, hot, and sweating stages, which returned for about a week, when it ceased spontaneously upon the occurrence of an event which kept him out of his bed at the hour, and induced him to take a ride on horseback, which excited and warmed him. But cases of pure irritative intermittent are probably rare; and the presumption, when we meet with a case of ague and fever, is that it is miasmatic.

Intermittent, being the mildest form of miasmatic fever, is that which ordinarily occurs in situations, and at periods, when the miasmatic influence is least intense, and in persons who from habit, or any other cause, are least susceptible to injury from it. Though this particular cause may be essential, yet there are others which very much assist its action. The poison seems to find a more ready entrance into the system, when exhausted by fatigue or hunger, debilitated by previous disease or mental depression, and during sleep. It often lurks in the system without obvious effect, for a longer or shorter period of time, causing rather a predisposition to the disease than the disease itself. Under these circumstances, any exciting cause may call the fever into action; and sometimes an attack is produced, which might otherwise have been avoided. Exposure to the heat of the sun, a cold bath, excessive exertion, mental excitement, even a dose of purgative medicine, may thus give rise to a paroxysm. The contrast between the cold of the mornings and evenings and the heat of the middle of the day, favours the developement of the disease in the latter part of summer, and the beginning of autumn. Persons removing from a miasmatic region to a healthy one are often attacked, in consequence probably of the new and excitant influences to which they are exposed.

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* It is proper to state that, in a review of the first edition of this work, in the New Orleans Medical and Surgical Journal for May, 1848, it is declared by the writer, who appears to have had an extensive experience in miasmatic diseases, that he has "never seen a case in which the occurrence of an intermittent, during the progress of another disease, seemed of itself to have proved beneficial to that disease;" but, on the contrary, had generally observed a prejudicial influence of the new upon the original malady.—*Note to the second edition.*

The disease is most common in the latter half of summer, and in autumn before the occurrence of severe frost. Sometimes it seems to occur epidemically, making its appearance in situations where it was before almost unknown, and spreading over considerable districts; but still showing itself at the same season of the year. In the United States, it is occasionally met with in almost every part of the country where there are water and vegetation, except in certain mountainous regions, and through the greater portion of New England, where it is scarcely known. In Europe its northern limit is stated to be the 60th or 61st degree of north latitude. (*Arch. Gén.*, Mai, 1853, p. 516.) It occurs occasionally in the vicinity of Stockholm.

The time at which the disease attacks, after exposure to the miasmatic cause, is altogether indefinite. It may occur in a few hours, or not for weeks, or months. There is reason for the belief, that the cause may remain latent for a year or more, until called into action by favouring circumstances.

Infants and old people are less frequently affected than those of intermediate ages, and women less than men, probably because they are less exposed to the cause. Children are certainly liable to it at the tenderest age, and it is thought to have attacked the fœtus in the womb, as indicated by the periodical trembling in the uterus, of which the mother, when herself the subject of the disease, has been sensible in the interval of her own paroxysms. Negroes are much less susceptible of the disease than whites.

DIAGNOSIS.—The only diseases with which intermittent fever is liable to be confounded are hectic and remittent fever. Hectic fever, however, may in general be easily distinguished by the irregularity in the recurrence of its paroxysm, the comparative absence of headache, the excessive and prolonged sweats at night, the clearer complexion and brighter eye, the frequent want of gastric derangement and fur on the tongue, the continued frequency of pulse throughout the interval, and the serious organic diseases of which the hectic is usually a mere symptom. Remittent fever is distinguishable only by the continuance of fever during the whole interval; and sometimes it is very difficult to decide whether the case belongs to the one or the other variety.

PROGNOSIS.—In the uncomplicated form of intermittent fever, without malignant tendency, the prognosis is almost always favourable. I have never seen such a case eventuate fatally. It is possible that, when there is a disposition to cerebral disease, with the brain perhaps already softened, fatal apoplexy may be induced in the paroxysm, either from the venous congestion of the cold stage, or the strong determination of blood in the stage of reaction. There is reason to believe that such a result does sometimes occur, especially in the old, and in the intemperate. Inflammation of any of the vital organs may of course give rise to danger. Instances of fatal effects from congestion and rupture of the spleen have occurred. But the chief danger of ordinary intermittent is from those secondary affections which result from its neglect; such as chronic enlargement and induration of the liver and spleen, and dropsy. Even in these cases, however, the prognosis is more favourable than in similar affections proceeding from other causes. It is not uncommon to see cases of the cachexy of intermittents, with disease of the liver, jaundice, dropsy, &c., of apparently the most unpromising character, give way to appropriate treatment.

The more complete is the apyrexia, the more readily will the disease generally yield. The postponement of the paroxysm by two or three hours or more at each recurrence is a favourable sign. So also is the appearance of an herpetic eruption about the lips and the alæ nasi. Relapses usually yield more readily than the original disease; and the vernal cases than the autumnal. Of the different types, as a general rule, the quartan is the most difficult of cure, and the tertian the easiest.

TREATMENT.—The question was formerly much agitated, whether it was best to attempt to arrest intermittent fever, or to allow it to run its natural course. In favour of the latter plan it was urged, that a morbid matter existed in the system which the paroxysms tended to eliminate; that the disease acted favourably in preventing or removing other diseases, when permitted to have its full and unimpeded influence; and, lastly, that it was much less liable to return, when not interrupted. But this reasoning is fallacious. There is no proof that a morbid matter exists in the system, which is thrown off by the disease; if other complaints might sometimes be eradicated by its long continuance, the remedy would in general be worse than the evil; and observation has shown that the longer the disease has continued, the more liable does the system become to it, and the more difficult is it to be eradicated. Besides, so long as it lasts, there is constant danger of those secondary diseases, more serious even than the original, which not unfrequently result from it. The inference is, that it should not be allowed to continue if it can be arrested; and the sooner it can be checked the better. Happily, it is almost always in our power to arrest it very speedily.

In the Paroxysm.—In the great majority of cases, the paroxysm requires little treatment; and, even if it be left to nature, no serious harm will be likely to ensue. But there are some instances in which remedies are important; and, in almost all, the symptoms may be more or less alleviated. During the chill, the patient should lie in bed, and be covered warmly. Hot drinks may be given, such as lemonade, toast-water, or infusion of balm; and heat applied externally, by means of hot pediluvia, or of heated bricks, bottles of hot water, bags filled with hot sand or bran, &c., placed near the feet and along the body. When the chill is severe and protracted, the hot vapour bath may be employed, by raising the bed-clothes over the patient by means of crossed half hoops, and then placing hot moistened bricks wrapped in flannel near the body, or introducing a current of hot air and vapour through a large conical curved tin tube, within the broad exterior end of which a cup of alcohol is burning, as in Jenning's vapour bath.

Another excellent remedy, under similar circumstances, and especially when there is much pain or nervous disorder, is a grain of opium, or an equivalent dose of one of its preparations. This often affords great relief to the patient, and sometimes shortens the chill, and moderates the subsequent fever. Should the stomach be irritable, the anodyne may be given by the rectum. In this case, fifty or sixty drops of laudanum should be administered in two fluidounces of thin starch, or flaxseed mucilage.

When there is great and threatening prostration of strength, as indicated by faintness, and a very feeble or almost absent pulse, it is necessary to stimulate the patient; and, for this purpose, carbonate of ammonia and the oil of turpentine internally, and active rubefacients externally, are preferable to the alcoholic stimulants, because less likely to affect the head injuriously, when reaction shall have taken place. Nevertheless, it may become necessary to have recourse to wine, or even to brandy, especially in the cases of drunkards. Ether is sometimes applicable, in consequence of the rapidity and brevity of its action. The rubefacients will be most effective in these cases, when accompanied with heat. Cayenne pepper heated in brandy, and hot oil of turpentine, should be applied by friction to the upper and lower extremities; and mustard cataplasms, previously warmed, may be applied to the inside of the thighs, and over the epigastrium.

When the chill is attended with much oppression of stomach, nausea, and ineffectual efforts to vomit, an emetic dose of ipecacuanha may be given; or, if the patient is at the same time very feeble, a teaspoonful of powdered mustard diffused in warm water. Irritability of stomach should be treated, first, if the discharges are acrid, sour, or bilious, with a copious draught of warm water so as to wash out the stomach, and afterwards, if not relieved by this remedy, with a sinapism to the epigastrium, and an anodyne enema.

In comatose cases, reliance must be placed chiefly upon revulsion by external stimulants; but, should the symptoms be apoplectic; should there be stertor, for example, with a suffused face, and a slow laboured pulse, it may become necessary, in addition, to take blood from the arm, or by cups from the temples or back of the neck; the head being kept in an elevated position.

Besides the remedies above mentioned, others have been recommended. One of these is the tourniquet applied to the thigh. This cannot act, as has been suggested, by throwing more blood upon the vital organs; for, if made so tight as to arrest circulation altogether, it leaves the same proportion of blood in the remainder of the system as before; if applied so as to check the flow of blood in the veins only, it accumulates blood in the limb, and thus abstracts it from the remainder of the system. So far, therefore, as the circulation is concerned, it can act only by diminishing the quantity of blood to be forwarded by the forces concerned; which, as I believe, is a very doubtful benefit. From the testimony, however, in relation to its effects, there can be no doubt that the remedy serves occasionally to shorten the paroxysm. But so will anything else which strongly excites the attention and interest of the patient, especially if, as in the present case, it be attended with disagreeable sensation. A few strokes with a lash would probably be as effectual as the remedy in question.

Bleeding in the cold stage has been strongly advised, especially by Dr. Mackintosh and Mr. Twining. The former author asserts that, in the great majority of cases, it will cut short the cold stage, will rarely fail in stopping the paroxysm, and will often effect a cure of the disease. The amount of the requisite loss of blood is very uncertain, varying, according to the experience of Dr. Mackintosh, from an ounce and a half to twenty-four ounces. The tremors cease during the operation, the breathing becomes regular, the pains in the head and back vanish, the pulse becomes fuller and stronger, and a gentle moisture breaks out upon the surface of the body. The measure of the quantity taken must be the production of these effects; but, should the pulse fail under the operation, the wound in the arm must of course be closed immediately. Mr. Twining speaks with scarcely less positiveness of the efficacy of the remedy; but he requires that it should be preceded by purging, that the blood should be drawn from a large orifice, as soon as the cold stage is fairly formed, with the patient in a recumbent posture, and that no more should be taken than is necessary to arrest the paroxysm. Other practitioners have employed the remedy with various success. The general result of the testimony appears to be, that the cold stage is often shortened, and the hot stage sometimes moderated; but that no such amount of benefit is expe-

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rienced as to counterbalance the obvious objections to the measure. It has always appeared to me to be opposed to a sound pathology. The congestion of the cold stage is the result of a depressed condition of the nervous system, in which the heart and pulmonary capillaries participate. The blood, imperfectly transmitted through the vessels of the lungs, and imperfectly forwarded by the heart, accumulates necessarily in the venous system behind these points of obstruction. It is not the accumulation of blood that produces the prostration, but this that causes the accumulation. How then can the abstraction of blood lessen the difficulty? If the heart and lungs acted feebly because they were overloaded, then the removal of a part of the burthen might be useful; but the fact is, I believe, that they are overloaded because they act feebly. How then can the asserted effects of bleeding in the cold stage be accounted for? Partly, I believe, by the influence upon the imagination of the patient. I have no doubt that the mere tying of his arm, as in the application of the tourniquet, would have in a considerable degree the same effect. The loss of an ounce or two of blood is said sometimes to have produced a complete solution of the paroxysm. Is it possible to conceive that the heart and lungs, and all the interior viscera, should have been overwhelmed by having in them one or two ounces of blood beyond their proper capacity; and is it not probable that the solution would have equally taken place, if, with the same amount of preparation, and an equal belief on the part of the patient that everything was going on favourably, no blood whatever had flowed? Besides, a chill very often changes spontaneously, within the time that is occupied in the preliminaries and the operation of venesection. May it not be that, in many of the reported cases, the same result would have happened without the bleeding? I do not, however, assert that the modified state of the impression of the blood upon the nervous tissue, consequent upon the loss of a portion of the impressing agent, may not sometimes hasten reaction when there is a strong disposition towards it; just as the impression of sudden cold upon the surface, already chilled, will sometimes have the same effect. But, even allowing this to be the case, there are other means of obtaining the result when desirable, which are not liable to the same objections. The loss of blood, when not necessary, should always be avoided, on account of its debilitating effects. Unless under peculiar circumstances, which have already been noticed, it is never indispensable in intermittents. There are cases in which it might reduce a prostration, but just within the control of remedies, below the point of reaction. Why then resort to it?

In the *hot stage*, the patient should be placed upon a refrigerant treatment. He should be allowed cold drinks, in such quantities as not to oppress the stomach. The effervescing draught, given every hour or two, is an admirable remedy in these cases. It soothes the stomach, diminishes fever, promotes perspiration, and favours a solution of the paroxysm. It is also, when properly prepared, usually very grateful to the patient. Its effects will be increased by the addition of small doses of tartar emetic, when there is no sickness of stomach. The antimonial, however, is seldom necessary, and should never be given in quantities sufficient to produce nausea. Should the materials for the preparation of the effervescing draught not be at command, twenty grains of the citrate of potassa, dissolved in water or carbonic acid water, may be substituted. The solution of acetate of ammonia may be employed for the same purpose; but it is much more disagreeable, and, according to my experience, not nearly so effectual.

In very few cases will it be necessary to resort to other remedies. When the pulse is full, strong, and hard, with severe pain in the head, or pain in any other part, leading to the suspicion of inflammation, it may be proper to take some blood. Should the evidence of inflammation be unequivocal, the remedy should be resorted to without hesitation, unless the case present equally strong evidence of debility. In the latter event, blood may often be advantageously taken by cups or leeches from the neighbourhood of the part affected.

When the system is feeble, and especially when there is a tendency to a typhoid condition of the fever, the powder of ipecacuanha and opium (Dover's powder), in the dose of ten grains, is an excellent remedy. It may also be used in any case in which the patient suffers with nervous pains during the paroxysm, unless there are evidences of active cerebral determination or inflammation. Dr. Lind recommends opium generally in the febrile stage, having found it almost always to abate the violence, and shorten the duration of the paroxysm. I have not employed it except under the circumstances, and in the mode mentioned above, and can, therefore, give no authoritative opinion of its use in ordinary cases; though I must confess it would be opposed to my views of its stimulant influence on the brain, to administer it in cases of strong sanguineous determination to that organ.

Irritability of stomach is generally best allayed by the effervescing draught, or cold carbonic acid water. Should these fail, recourse can be had to the measures recommended for the same symptom in the cold stage.

Some have recommended the external application of cold water. This no doubt relieves the febrile heat, and conduces to a solution of the paroxysm. It should not be employed when there is the least moisture upon the skin. It is most conveniently applied by sponging. Dr. Dickson, of Charleston, recommends the cold bath, but avoids it in the old, the infirm, and those labouring under pulmonary disease or diarrhœa. (*Essays on Pathol. and Therap.*, i. 274.)

In the sweating stage, nothing more is requisite than to take care that the patient be not exposed to cold, so as prematurely to check the discharge.

In the Intermission.—This is the period for the effective treatment of intermittents. The course to be pursued is happily as simple as it is effectual. First, the bowels should be thoroughly evacuated, and then sulphate of quinia should be given freely. Formerly, it was customary to administer an emetic; but this practice is unnecessary, disagreeable, and sometimes mischievous, and has gone out of use. The only condition in which vomiting is clearly indicated is when the stomach is loaded with undigested food, or oppressed and irritated by acrid accumulations. For the cathartic effect, calomel, as a general rule, is preferable to all other articles of the class. It not only evacuates the bowels, but unloads the congested liver. It should generally be combined for adults with some other purgative to insure its action. Three or four of the compound cathartic pills may be employed, or from five to fifteen grains of calomel, with a proportionate quantity of rhubarb, jalap, scammony, or compound extract of colocynth; or the dose of calomel may be given alone, and followed in six hours by a dose of sulphate of magnesia or castor oil. When the apyrexia is very short, so as not to allow time for the action of a purgative, and the subsequent administration of quinia, the calomel may be given during the paroxysm. In mild cases of ague, with no signs of biliary disorder or hepatic congestion, it will be sufficient to evacuate the bowels thoroughly by sulphate of magnesia, or one of the other saline cathartics, or by the infusion of senna with Epsom salt.

As soon as possible after the bowels have been evacuated, it will be proper to commence with Peruvian bark, or one of its preparations. Of these, the most valuable is sulphate of quinia. Formerly, the bark in substance was much used; but, in consequence of its bulk, and of the nauseating property of some of its ingredients, it was found impossible, in many instances, to administer it in sufficient quantities to produce its full effects; and hence it often happened that cures were greatly protracted, and sometimes it was necessary to resort to other remedies. At present, it has been almost superseded by quinia, which appears to possess its antiperiodic property in a very high degree, if not completely; and may be given in cases in which the bark in substance would not be borne. Moreover, by increasing the dose of quinia to such a degree that no stomach would support an equivalent quantity of bark, we may obtain effects from the former, which could not be obtained from the latter. Various salts of quinia have been recommended; but no one I believe is superior in efficacy, or in any other valuable property, to the officinal sulphate. That medicine comes as near to the character of a specific in intermittent fever as possible. I have employed it extensively both in public and private practice, ever since it was first introduced into use; and, except in two instances, have never failed in arresting the paroxysm in regular uncomplicated intermittents; and, even in those instances, which occurred early in my practice, I believe that it would have proved effectual had it been administered in the quantities in which we now give it in obstinate cases. It will often arrest the disease immediately, so that the patient shall not have another paroxysm, especially in the tertian and quartan, in which time is allowed, during the intermission, for evacuating the bowels, and getting down a sufficient quantity of the medicine. If it fail with the first, it will generally succeed with the second paroxysm; and the cases are very rare in which a third will occur, supposing the intermission to be complete, and the proper previous preparation to have been made. When the first and second paroxysms return after its use, they are generally milder, and often postponed. All that we can say of its mode of action is, that, by its impression on the system, and especially, in all probability, on the brain or nervous system generally, it supersedes the paroxysm, on the principle, that, as our frame is constituted, there is a strong indisposition in it to support two morbid actions at the same time, in the same part. The regular return of the intermittent paroxysms appears to depend upon a concatenation of actions, which, if broken in any one link, is either dropped altogether, or resumed only at a more distant period.

There has been, and continues to be a difference of opinion upon the point, whether quinia should be given, in a complicated intermittent, during the continuance of any inflammation which may be associated with it. On the one side, it is maintained that the quinia must, by its stimulating properties, aggravate the inflammation; while, in consequence of the constant irritation which this sustains in the system, it will fail to subdue the paroxysmal disease. On the other side, it is answered, that quinia is capable, as proved by the result of innumerable trials, of arresting the intermittent paroxysms under the circumstances mentioned; that the stimulus of the paroxysmal pyrexia is infinitely greater, and infinitely more likely to support and aggravate the inflammation, than that of the quinia; and that, consequently, the sooner this medicine is administered the better. According to the former opinion, the inflammation should be first subdued by the lancet, cupping, &c., after which recourse may be had to the antiperiodic remedy; according to the latter, the paroxysmal disease should be immediately arrested, and then, if the inflammation shall not cease at the same time, it can be treated in the ordinary manner. There is a simple rule which, I think, will serve the practitioner as a sufficient guide in relation to this disputed point. Whenever the intermission is complete, in other words, when it is quite exempt from fever, quinia may be given without hesitation, if the stomach will support it. If any existing inflammation is of so low a grade as not to induce symptomatic fever, it will scarcely oppose an obstacle to the antiperiodic action of quinia, and will be much more likely to yield after the paroxysms have ceased. Indeed, such inflammation is probably often supported by, if it do not originate in, the fever of the paroxysm. When the inflammation is so extensive or severe as to induce fever, though the disease may have the paroxysmal form, yet it will present rather the aspect of a remittent than an intermittent, as there will be fever steadily throughout the interval. In such cases, the use of quinia should be preceded by depletion, and other measures calculated to reduce the inflammation; but, as soon as a distinct intermission has been obtained, there should be no longer any delay in resorting to the antiperiodic remedy. When the inflammation is attended with typhoid symptoms, or a low state of system, as not unfrequently happens in the southern and western portions of this country, especially in the winter, when typhoid pneumonia supervenes upon, or becomes complicated with intermittent fever, it will be proper not to wait for a distinct intermission; but to administer the quinia as soon as the nature of the disease is clearly ascertained. I have seen the happiest effects result from this treatment; and have been informed by physicians, residing in miasmatic regions, that they habitually employ it with great advantage. Not only is the intermittent interrupted, but the inflammation itself puts on a more favourable character under its influence.

From twelve to twenty-four grains of the sulphate of quinia should be given between the paroxysms, and continued in this quantity until the disease is arrested. The amount required is very different in different individuals. Some are very easily affected by the medicine, as shown by the buzzing or roaring in the ears, and partial deafness which they experience, after having taken but a small quantity; while in others, very large quantities are requisite to produce the same effect. The cerebral sensations produced by the medicine may be considered as a sign of its action on the system; and, when they are experienced, it is usually unnecessary to push the quinia further than may be requisite to sustain them in a moderate degree. Should they be severe, the medicine should be suspended until they subside. It is seldom, however, that less than twelve grains, in each intermission, can be relied on. I have repeatedly known cases, treated for a considerable time with smaller doses without effect, to yield immediately to the medicine in larger quantities. When, therefore, the disease is not interrupted at the second paroxysm from the commencement of the treatment with quinia, the medicine should be increased to any amount which may be necessary to produce its peculiar effects upon the brain, whether that amount be the larger quantity above mentioned, or much more.

Some physicians are in the habit of prescribing very large quantities of the sulphate, in all cases indiscriminately. From thirty to sixty, or even one hundred grains, have been given during twenty-four hours. These amounts may be required in certain malignant cases, but seldom or never in the disease as it ordinarily occurs. I do not remember ever to have found more than twenty-four grains, in that period of time, necessary. These enormous doses are not without risk. There is reason to believe that permanent deafness has resulted from them. One such case has come under my own observation; at least the affection was ascribed to that cause by the attending physician. Where there is a tendency to cerebral inflammation, it would be very likely to be developed by large doses of quinia; and cases of this kind are upon record. Besides, to employ the quinia so profusely in ordinary cases, is to make great waste of a most valuable and a costly medicine, and thus unnecessarily to enhance the price.

Upon the whole, I prefer the plan of administering the medicine in small doses frequently repeated, and of distributing it equally through the apyrexia, the time of sleep being as a general rule omitted. It is desirable that the rest of the patient should not be broken, if it can be avoided. Small doses, at short intervals, are preferable to large ones at long intervals, because they afford a better opportunity for the absorption of the medicine. There can be little doubt that it operates by entering into the circulation; as it can be detected in the urine by chemical tests. Another advantage of the small doses is, that they are less likely to oppress or irritate the stomach. Some give the whole quantity requisite for a single intermission at one dose, which, according to one party, should be administered immediately after the paroxysm, according to another, but a short time before it. There are circumstances which render such a course advisable; as, for example, when the period of the apyrexia is very brief, as sometimes happens in the quotidian; when it is of the utmost importance to prevent the paroxysm, and there is but a short time to do it in; and when it is highly desirable not to interrupt sleep, and the period of the intermission corresponds exactly with that of rest. In such cases, the medicine should, if possible, always be given some hours before the expected recurrence of the paroxysm, so that time may be allowed for its absorption. Its operation should be in full vigour at that time.

The medicine should not be given during the pyrexia, in ordinary cases. There is some danger that it may aggravate the fever and the cerebral affection, while there is almost always time sufficient in the interval. It should always be persevered with, as long as the least vestige of a paroxysm remains. Should the physician suppose that he has conquered the disease, when he has reduced the violent ague and fever to a few disagreeable sensations at the regular period, and, under this supposition, omit the medicine, he will frequently be disappointed to find the paroxysms returning, and gradually resuming their original violence. When the paroxysm of a quotidian has been interrupted, it is proper always to continue the medicine for another day, until it be ascertained whether the disease may not be disposed to assume the tertian type; and, if the physician wish positive security, it may be advisable to carry the patient through the day when the paroxysm would return, were the disease to become quartan. This, however, is very rarely necessary.

One or two grains of the sulphate may be given, under ordinary circumstances, every hour or two hours, until the requisite quantity has been administered. It is of little consequence whether it be given in pill or solution. I have found the two forms equally effectual. The pill is generally dissolved with the utmost facility in the stomach, in consequence of the presence of an acid there. It should, however, be freshly made, when it is desirable that it should act promptly. The solution is generally preferable in the cases of very young children; and there are some persons who cannot, or who think that they cannot swallow a pill, and who must, therefore, have the medicine in the liquid form. Besides, when it is of great importance that it should act promptly, as there may possibly be no acid in the stomach, we may perhaps rely with more certainty on the solution than the pill. The solution is made by acidulating the water employed. For this purpose, the aromatic sulphuric acid or elixir of vitriol is the most elegant addition; and, for every grain of the sulphate, one and a half minims of that preparation may be used.*

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* ℞.—Quiniæ sulphat. gr. xvi; Acid. sulphuric. aromat. fʒss; Aquæ fluvial., *vel* Aq. menth. pip., *vel* Aq. camphoræ, f℥ij. A teaspoonful every hour or two. Liquorice may be added in the proportion of ℈ij, in order to cover the taste, when the medicine is intended for children.

Should the sulphate irritate the bowels, a few drops of laudanum, or a fluidrachm of paregoric elixir may be given occasionally. It has been recommended, in cases attended with constipation, to administer rhubarb with the quinia or bark. This, however, is not a good plan, as it tends to carry the medicine too rapidly out of the reach of the absorbents. It would be better to administer the cathartic separately, and at a time when the quinia is not to be continued, as at bed-time.

Should it be impossible to administer quinia by the stomach, in consequence of the irritability of that organ, it may be given with good effect by enema. A mixture containing twelve grains of the sulphate of quinia, thirty drops of laudanum, and two fluidounces of thin starch or flaxseed mucilage, with or without enough acetic acid to effect the solution of the sulphate, may be thrown up the rectum every six or eight hours. This mode of administration may also be resorted to when the urgency of the case requires that the medicine should be introduced by every avenue. It is sometimes also employed endermically, the sulphate being sprinkled upon a surface previously denuded of the cuticle by means of a blister. It is said to have acted efficiently in this way; but it is very apt to irritate the surface, and I have known considerable sloughing produced by it. When thus employed, it should be diluted with gum arabic, and applied in the same quantity as by the rectum, at least in cases of emergency.

Advantage sometimes results from combining the sulphate of quinia with other medicines. Opium probably adds to its antiperiodic power, and, when otherwise indicated, may be employed in connexion with it in the quantity of from one to three grains in twenty-four hours. In cases accompanied with great insensibility of stomach, and consequent deficiency of absorbent power, some gastric stimulant may be advantageously added to the sulphate. Of this nature are capsicum and black pepper. These are especially applicable to the cases of intemperate persons, and to those accustomed to the free use of stimulating condiments; and are probably more suitable to hot than to temperate latitudes. Some physicians employ piperin; but it is doubtful whether this is more efficacious than the black pepper itself from which it is derived. (See *U. S. Dispensatory*, Article *Piper.*)

Various cheaper preparations of bark have sometimes been substituted for sulphate of quinia. Sulphate of cinchonia is probably equally effectual in somewhat larger doses, and has recently been much employed with the best effects. It may be given in doses about one-quarter or one-third larger than those of the salts of quinia. The same remarks are applicable also to the sulphate of quinidia. An impure preparation, consisting of the sulphates of quinia and cinchonia, regular or amorphous, with some colouring matter, and often a portion of sulphate of quinidia, being the residue procured by evaporating the mother liquor left in the preparation of the officinal sulphate, has frequently been sold under the name of *extract of bark, impure sulphate of quinia, &c.* In double the dose, it has the same effect as the sulphate; but no reliance can be placed upon its purity. The alkaline matter, obtained by precipitating the mother-water above referred to by means of an alkaline carbonate, has also been much used under the names of *quinoidine, amorphous quinia,* and *precipitated extract of bark.* When pure, it is equally effectual with unaltered quinia, but is liable to the objection that, from its uncrystallizable character, it is more exposed to adulteration. (See *U. S. Dispensatory*, 10th ed., p. 1171.)

If quinia should happen to fail in interrupting the paroxysms, recourse may be had to Peruvian bark in substance. The officinal yellow (Calisaya), or the best red bark should be preferred. From one to two ounces should be given during the intermission, in doses of a drachm or two at a time. A good method of administration is to introduce the whole quantity of bark to be taken during the day into a bottle, containing as many wineglassfuls of water as there are to be doses; then to shake the bottle well, and pour out a wineglassful for a dose. Five drops of aromatic sulphuric acid may be added to the mixture, for every dose that it contains. Sometimes opium is a very useful addition; and, in debilitated cases, port wine may constitute a portion or the whole of the vehicle. (See *U. S. Dispensatory*.) The preparations of iron are often very advantageously associated with sulphate of quinia, especially in obstinate cases of the disease, connected with an anemic state of the circulation, and much disposed to relapse. I prefer for this purpose the *pill of carbonate of iron* of the U. S. Pharmacopœia.

An elegant preparation of Peruvian bark, probably containing all its virtues, is the compound infusion of the U. S. Pharmacopœia, made with the addition of elixir of vitriol. From one to two pints of this, between the paroxysms, will be requisite for the cure of intermittents. One of the tinctures of bark may be added to the sulphate of quinia, in cases of great debility, or in those of drunkards; from fʒj to f℥ss being given with each dose. The use of bark in the form of jackets, cataplasms, and baths, has been entirely superseded by sulphate of quinia.

Various obvious inducements have led to an industrious search, at different times, for substitutes for Peruvian bark, or its active principles, in the treatment of this disease. Many of these have been introduced to the notice of the profession, with the highest commendation; and not a few of them have ranked, in the partial estimate of their recommenders, as equal if not superior to the Peruvian tonic. Few of them, however, have stood the test of trial; and not one has yet satisfied the profession generally of its claims to supersede the sulphate of quinia. In judging of the value of the strong testimony which is every now and then adduced in favour of some new remedy in intermittents, it must be recollected that this disease not unfrequently ceases spontaneously, and that it may very often be interrupted by anything calculated to make a strong impression on the mind of the patient. Thus, amulets and charms have frequently been supposed to cure the disease. Hence, too, the credit acquired by certain disgusting remedies, which produce a shudder when they are swallowed. The expedient of putting forward the hour hand of a clock, so as to make the patient believe that the time for his chill has passed, is said to have sometimes had the effect of preventing its occurrence. Certain individuals are supposed by the vulgar to possess a supernatural influence over the ague, which disappears at their command. I have known of two individuals who were believed to possess this power, and who frequently cured the disease by assuring the patient that he would miss his chill at a certain time. Here is the effect of faith. It may thus be easily understood how various substances, having no real influence over the disease, should have acquired the credit of cures in the complaint. Physicians may legitimately make use of this principle of faith. By strong assurances that the patient will miss his paroxysm, if properly obedient to directions, the efficacy of the sulphate of quinia itself may sometimes be increased.

But there are certain remedies which really possess some antiperiodic power, and are capable of effecting positive cures of the ague and fever, though none comparable with quinia. The one which approaches most nearly to it in efficacy is probably arsenic. In the form of solution of arsenite of potassa or Fowler's solution, this was much used before the discovery of quinia. It had the advantage over the bark of being tasteless, or nearly so, and therefore more readily administered to children, and persons of delicate stomachs. Even at present, we may sometimes perhaps advantageously recur to it in infantile cases, when the solution of sulphate of quinia is obstinately rejected on account of its taste, and sufficient influence cannot be found to control the will of the patient. It may also be used sometimes beneficially, when the apyrexia is incomplete, and we may fear to administer quinia in consequence of some existing phlegmasia. Some think that the disease is less apt to return, after being arrested by arsenic, than after the use of the preparations of bark. The dose of Fowler's solution is ten drops three times a day. It may be continued until the disease is arrested, or until some œdema of the face, oppression of stomach, general tremours, or feelings of muscular weakness, evince the action of the medicine. It must then be suspended, lest the poisonous effects of the arsenic should be produced. I have known a case of universal anasarca apparently arise from its use in a child. It cannot, in general, be continued with propriety much beyond a week. For infants, the dose must be diminished in proportion to the age. To a child a year or two old, a drop or two may be given three times a day.

The salts of various other metals have, in some measure, the same antiperiodic power. *Sulphate of copper* is among the most efficient. It may be used in connexion with quinia, in the dose of one-fourth of a grain.* *Sulphate of zinc*, in the dose of a grain or two, and different *salts of iron* have had some reputation. *Ferrocyanuret of iron*, or *Prussian blue*, has been much praised. It was introduced into practice by Dr. Zollickoffer, of Maryland, who considered it even superior to Peruvian bark. Dr. Samuel Jackson, formerly of Northumberland, Pennsylvania, employed it with great success, though he did not find it equal to the bark. Out of two hundred cases in which it was given by him, it failed to produce an immediate suspension of the paroxysm only in a fifth or sixth of the cases, and in most of these proved successful in the second, third, or fourth interval. Dr. Zollickoffer gave about six grains twice or three times a day; Dr. Jackson one or two drachms during the interval. (*Am. Journ. of Med. Sci.*, ii. 335.) I used the medicine, when it first came into notice, in a few cases; but, though it was attended with some success, the bark proved so much more certainly efficacious, that I quickly abandoned it. The persesquinitrate of iron has been used successfully by Mr. William Kerr, in West Canada. (*Month. Journ. of Med. Sci.*, Oct. 1851, p. 336.) Fordyce states that *tartar emetic* or *ipecacuanha*, given every four, five, or six hours, in doses, as large as can be borne without nauseating, will often carry off the disease. *Sulphur* has been highly spoken of as an antiperiodic. Dr. Chapman gives a favourable opinion of it; and Dr. Dickson, of Charleston, considers it a most valuable remedy in various intermittent diseases, and especially applicable to intermittent fever when the apyrexia is incomplete. *Alum* has long enjoyed some reputation. *Tincture of iodine*, in doses of thirty drops, repeated three times during the apyrexia, and increased, if necessary, to forty, fifty, or sixty drops, has been highly recommended in very obstinate cases. (*Am. Journ. of Med. Sci.*, N. S., xiv. 223.) *Sal ammoniac* has long been occasionally used; and Dr. Aran found it successful, in the whole of thirteen cases in which he tried it, in the quantity of two drachms taken in two doses, with the interval of half an hour, in the apyrexia. (*Archives Gén.*, 4e sér., xxvii. 351.) Dr. Montdezert, of France, has recently called attention to *common salt* as a powerful antiperiodic; and its efficacy has been attested by M. Piorry, and by Drs. Lattimore and Hutchison in this country. By the last mentioned practitioner it is considered inferior only to quinia. Among its asserted effects, besides a solution of the paroxysm, is a remarkable diminution in the bulk of the spleen. The dose is about a drachm, given at intervals so as to amount to half an ounce or an ounce in the apyrexia, dissolved in coffee, infusion of slippery elm, or other convenient vehicle. (See *Archives Gén.*, 4e sér., xxviii. 343; *Am. Journ. of Med. Sci.*, N. S., xxiv. 101; *N. Y. Journ. of Med.*, N. S., xii. 159.)

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* ℞.—Cupri sulphat. gr. j; Opii pulv. gr. j; Quiniæ sulphat. gr. viij; Acaciæ pulv., Syrup, āā q. s. Misce et fiant pil. no. iv. S. One four times a day.

Almost all the vegetable tonics and astringents have been employed in the treatment of intermittents. From the strong testimony in its favour, there is reason to think that our *Cornus Florida*, or *dogwood bark*, is not without efficacy. The barks of the *wild cherry* and *tulip tree* of this country, of different species of *willow*, of the *horsechestnut*, of the *oaks*, of the *mahogany* and its congener *Swietenia febrifuga*; all the *simple bitters*, as *quassia*, *gentian*, &c; *wormwood*, *chamomile*, and *eupatorium* or *boneset*; the *leaves of the olive tree*; *kino* with nutmeg; *pepper* or *piperin*, *sage*, *coffee*, and a host of others of the same classes, have been enumerated among antiperiodic remedies. Much was said at one time of the extraordinary efficacy of *salicin*, or the active principle of the willow; and it is probably not without power, though greatly overpraised. *Nux vomica* had formerly some reputation as a febrifuge, and the use of it has been revived in the form of strychnia. *Sulphate of bebeerin* has been used with great asserted success; from a scruple to a drachm being given in the intermission, in doses of two grains each. *Narcotina* has been brought into notice by Dr. O'Shaughnessy, of Calcutta; and numerous cases have been adduced in proof of its efficacy. He gave it in the dose of three grains three times a day, in connexion with muriatic acid. I have never been able to divest myself of the suspicion, that, as employed in India, it contained a portion of morphia. *Charcoal*, though greatly praised, is probably inert. The same may be very confidently said of *gelatin*, though this also has had its advocates. *Spider's web*, in the dose of from five to ten grains every two, three, or four hours, originally employed by Dr. Gillespie, of the Isle of Man, was afterwards used successfully by Dr. Jackson in the West Indies, and Dr. Condie and others in this country (*Notes to Watson's Practice*, Am. ed.), and has enjoyed considerable reputation. Chloroform has recently been proposed as a remedy. All the above substances have been employed in reference to a supposed antiperiodic property. Many of them have undoubtedly cured intermittents; but all of them are liable to failure; and no one has yet approached the reputation of Peruvian bark.

There is another mode of treating intermittents which is often effectual, and may sometimes be resorted to with advantage. It consists in making upon the system a strong and obvious impression, in immediate anticipation of the paroxysm, so as completely to preoccupy the ground, and thus preclude the entrance of the disease. One of the most efficacious measures of this kind is the employment of an *emetic*, so as to be in full operation at the moment when the paroxysm is expected. In this way, the decoction of boneset (*Eupatorium perfoliatum*), taken warm in the quantity of a small bowlfull, the patient being covered in bed, will often prove effectual. It operates as an emetic, throws the patient moreover into a profuse perspiration, and sets aside the paroxysm, which generally does not return. This plan of treatment is admirably adapted to cases in which there is a slight fever throughout the interval. I have repeatedly employed emetics, under these circumstances, with great benefit.

Opium given in a full dose, an hour or two before the paroxysm, operates in the same way, and more agreeably, though perhaps less effectually. Any other stimulant will occasionally have a similar effect. *Brandy*, *musk*, and *ether* have been employed. But the risk from all these medicines is, that, if they do not arrest the paroxysm, they may aggravate the fever, and endanger inflammation of the brain, should any tendency to that affection exist.

Large blisters upon the extremities, applied so as to be in full operation at the time for the paroxysm, sometimes prevent its return. But they are applicable rather to remittents than to intermittents. Powerful rubefacients, such as *mustard, ammonia, or oil of turpentine applied to the spine,* may be occasionally effectual in the same manner.

With this set of remedies may also be ranked the plan, said to have proved effectual in one very obstinate case, of pushing the patient without warning into deep water, and thus making a powerful impression at once upon his mind and body. Of analogous effect is the *affusion of cold water,* employed an hour or two before the paroxysm, in the form of a general shower bath, and of a local douche to the region of the spleen.

When the return of one paroxysm has been prevented by any of the means above detailed, the disease is generally arrested for a time, and often permanently. But not unfrequently some functional disorder of the chylopoietic viscera remains, which requires attention; and advantage will often accrue from the use of a mercurial pill, every night or every other night, with attention to the state of the bowels, for a week or a fortnight. It may also be useful, when the digestion is feeble, to administer one of the simple bitters. Nitromuriatic acid is an excellent remedy under these circumstances; but it should not be used in connexion with the mercurial. In anemic cases the chalybeates should be given.

It has been stated that relapses are frequent in this disease. They are indeed among the circumstances which give the practitioner most trouble. I have found, however, by ascertaining the period at which the disease is disposed to return, which is generally remarkably regular in each case, that the recurrence may almost always be prevented, and the disease finally eradicated, by a persevering system of anticipation. In most cases, the first recurring paroxysm shows itself about two weeks from the time of the last chill. All that is necessary is, *two* days before this period of expected relapse, to give as much sulphate of quinia as might be requisite to arrest the disease if formed; namely, from six to twelve grains each day. This plan should afterwards be continued weekly for a month or two. At the end of the latter period, the disposition is generally very much subdued, though perhaps not fully eradicated; as exciting causes may afterwards induce a recurrence of the disease. This, when it takes place, should immediately be met with quinia, no matter how slight or imperfect the first recurring paroxysm may be, and the same plan of anticipation pursued as before.

Sometimes, these relapsing cases may be advantageously treated by placing the patient upon the steady use of three or four grains of sulphate of quinia daily for two or three months. I have found also the infusion of wild cherry bark, in the dose of a wineglassful four times a day, continued in the same manner, apparently effectual. Wormwood has had considerable reputation as a preventive of relapses. It is used in tincture or infusion, and given twice or three times a day. The preparations of iron and of manganese may be usefully employed where the tendency to relapse is connected with anæmia. In some instances, however, this tendency is so adhesive as to resist everything in the shape of medicine that can be employed. It may be corrected for a time, but is apt to show itself when the patient is off his guard, sometimes after it may have been supposed to be thoroughly eradicated. In these cases, however, by arresting the disease as soon as it appears, mischief is prevented, and ultimately, in the course of one, two, or three years, the morbid tendency appears to exhaust itself. Great advantage often accrues by changing completely the circumstances in which the patient may be placed, and bringing a new set of influences to bear upon him. A voyage to sea, foreign travel, long journeys on horseback, &c., often completely eradicate the tendency.

The *diet*, during the continuance of the disease, should be light, digestible, nutritious, and unstimulating. For the first day or two, the patient should generally avoid animal food, and afterwards use the lighter kinds, such as milk, butter, soft boiled eggs, and boiled meats, in connexion with farinaceous substances and easily digested vegetables. Stimulating drinks should not be used. He should avoid eating a full meal within two or three hours of the expected paroxysm; as the food does not digest during the fever, and sometimes serves as a source of injurious irritation. When the intermission is complete, it is not necessary that the patient should confine himself to the house; though he should avoid fatigue. In some old cases, violent exercise on horseback between the paroxysms has proved remedial.

PREVENTION.—Miasmatic regions should be avoided from the first of July to the occurrence of black frost in the autumn. They who are compelled to reside in, or pass through them, at this season, should especially avoid the morning and evening air, and should never sleep out at nights. If necessarily exposed at these times, it should not be with the stomach empty, nor after fatigue or exhaustion of any kind. The intense heat of the sun in the middle of the day should be avoided or guarded against, and all kinds of excess should be scrupulously shunned. Individuals should be careful not to expose themselves to cold when heated, and never to remain long in wet clothes. Great alternations of temperature are very apt to induce the disease. The use of a fine gauze veil, or something equivalent to it, has been recommended, under the impression that it might exclude the miasmata. A much more effectual measure is to keep the system steadily under the moderate influence of quinia or Peruvian bark. This plan was recommended by Dr. Lind, in his treatise on the *Preservation of the Health of Seamen* (2d ed. p. 58), and has been since frequently put in practice with great success.

Perhaps the use of certain articles of diet may tend to counteract the effects of malaria. Frazer, in his travels in Persia (p. 16), states that in Mazanderan, a low, wooded, very moist, and very sickly district upon the borders of the Caspian, the inhabitants are in the habit of eating garlic freely, asserting that it protects them against the complaints of the climate.

REMITTENT FEVER.

Syn.—Bilious Fever.—Bilious Remittent Fever.

Besides the disease last treated of, two distinct fevers are endemic in the United States; one, the variety of miasmatic fever usually called *remittent*, which prevails in the latter part of summer and in autumn; the other, the complaint known by the names of *common continued fever*, *typhoid fever*, *dothinenteritis*, &c., which occurs most frequently during cold weather. So peculiarly are they diseases respectively of the seasons mentioned, that the former may be considered as the autumnal, the latter as the winter endemic of our country. Either of them, however, may occur at any period of the year; and the two not unfrequently exist at the same time. As they often bear no inconsiderable resemblance to each other, and yet require, in some respects, very different treatment, it is of great importance that they should be distinguished; and the attention of the student is called to them in this place, in order that he may have his mind especially directed to their diagnostic characters. This is the more necessary, as the two diseases have been, and still are not unfrequently confounded by practitioners.

Remittent or bilious fever occurs more or less in almost all parts of the United States, lying between the Northern Lakes and the Gulf of Mexico; but is much more frequent in the middle and southern sections than in the northern. In some parts of New England, it appears to be almost unknown; the common endemic fever of those regions being probably the winter fever above alluded to. It is rare in the mountainous and hilly districts of our country, except where there are large streams or standing water; also, in the dry sandy regions covered with pine forests, and in the middle of cities. Hence, these are frequently the resort of the inhabitants of miasmatic districts during the sickly season. The situations in which the disease is most prevalent are the valleys of streams, the borders of lakes or ponds, the neighbourhood of marshes, and the rich prairies of our Western States. Sometimes it occurs as a kind of epidemic in regions usually healthy, and occasionally rages in them with great violence. It is in general a much more serious disease, in the southern and south-western sections of the United States, than in those portions of the North which are still within the limits of its prevalence. But the disease is not confined to this country. It is endemic almost everywhere in hot climates, and especially where heat, moisture, and decaying vegetable matter act conjointly. (See *Miasmata*, p. 153.) Comparatively mild in temperate latitudes, it becomes extremely fatal in many places within the tropics. It is the disease of whose ravages in the East Indies, Africa, the Mediterranean, and South America, we have heard so much; which has depopulated the Campagna of Rome, and rendered intertropical Africa uninhabitable by whites. It was probably this fever that was best known to the Greek and Roman physicians, and upon which the descriptions of ancient medical writers were chiefly founded. It must not be confounded with the yellow fever, which is quite a distinct affection.

The disease has received numerous names, all of which are liable to objection. It is undoubtedly *remittent;* but there are other fevers which are more or less remittent, and cases of this fever sometimes occur in which it is difficult to detect any decided remission. It is often *bilious;* but so also is yellow fever in at least an equal degree; and it often happens that the one which we are considering does not show any special disorder of the hepatic function. It has frequently received names from the localities where it prevails. Thus, we hear of the *African fever*, the *Bengal fever*, the *Mediterranean fever*, the *Walcheren fever*, &c. &c. The complaint, as it prevails on the borders of our inland seas, is called *lake fever;* the people of cities which are exempt from it, while the surrounding districts are affected, often name it *country fever;* and the inhabitants of healthy uplands are apt to designate it *river fever* or *marsh fever*, from some stream or marsh in their vicinity, the borders of which are infested by it. All these are one and the same disease, and therefore improperly named. If its exclusive miasmatic origin be admitted, the title of *miasmatic remittent* would perhaps be the least objectionable of any hitherto given to it. I shall, however, call it indifferently remittent and bilious fever; and, when these terms are employed without qualification, they may be considered as belonging to the disease in question.

Types.—It has already been stated that miasmatic remittent fever is essentially the same disease as the intermittent. The two affections sometimes approach each other so closely in form, that it may be impossible, in relation to a particular case, to decide to which of them it belongs. In intermittents there is often some degree of morbid action between the paroxysms, and in remittents often very little; and it is not always possible to determine, whether the morbid action that exists does or does not amount to fever. If it be pronounced not to be fever, the disease must be considered intermittent; if fever, remittent. In the latter affection there is every grade, from the doubtful form just alluded to, up to an almost uniform continuous fever.

In many cases, the paroxysms of remittent occur at regular stated intervals, like those of intermittent, and, like them, consist of the cold, hot, and sweating stages, though in general less distinct and decided. In other cases, with the same regularity in the recurrence of the paroxysms, there is no cold stage after that of the accession of the disease, and the sweating stage is either slight or wanting. In others, again, the fever merely fluctuates in its course, at one time rising into a moderate exacerbation, at another falling into a moderate remission, without forming well defined paroxysms. Instances, moreover, do occur, though they are comparatively rare and always short, in which the fever pursues a uniform course, without discoverable relaxation, and sometimes with a regular increase, to the crisis.

All the above conditions may occur in the same case. At the commencement, there may be two or more regular paroxysms as in the intermittent; afterwards the paroxysms may recur regularly without the chill or the perspiration; and at length the fever may assume the continued form, and thus run on to its termination. Or, the disease may commence as continued fever, may after a time become paroxysmal or remittent, and may finally end in intermittent.

Remittent fever has the same types as the intermittent. The most frequent is the quotidian, with a paroxysm occurring at about the same hour every day. The tertian, with its every other day paroxysm, is not uncommon. The quartan is very rare. Next, perhaps, to the quotidian is the double tertian, having a daily paroxysm, but that of one day differing from that of the next, and the alternate paroxysms resembling each other both in character and time of occurrence. Thus, the paroxysm may occur one day in the morning, and the next in the evening; and all the morning paroxysms shall be regular, while those of the evening shall be in some manner modified, either very light and short, or without chill or perspiration, or attended with nausea, while those of the morning are attended with headache. A remittent may always be considered of the double tertian type, when, having an exacerbation every day, it is yet much worse on alternate days. Sometimes two exacerbations occur in one day, and only one in the next; and cases are occasionally met with, in which the principle of association between the exacerbations cannot be traced; as they every now and then make their appearance irregularly, and when least expected.

Some difference exists among writers as to the time of day at which the paroxysms of remittent fever are most apt to commence. The first onset of the disease appears to take place indifferently at any hour of the day; sometimes in the forenoon, sometimes in the afternoon, and occasionally even in the night, and the tendency is afterwards for the paroxysms to return about the same hour. But, when the disease approaches the continued form, and the commencement and termination of the exacerbations are not precisely marked, the disposition generally is to an increase of the febrile action in the evening, and a decline in the morning.

Grades.—There are two distinct modes in which we may estimate the grade of the fever; first, in reference to its greater or less violence; and, secondly, in reference to the greater or less energy of system which attends it. In both respects, bilious fever varies greatly. As regards the violence of the disease, it may be of all conceivable grades, from a mildness which scarcely confines the patient, or requires the interposition of remedies, to a severity which demands the promptest treatment to preserve life, and against which all the resources of nature and art occasionally fail. The degree too of the energy of system may be very different, and may give rise to marked varieties of the disease. The state of system may be sthenic, with the blood rich and abundant, and all the vital functions full of vigour; or it may be feeble, asthenic, or adynamic, with the vital forces exhausted by previous disease, intemperance, or other debilitating cause. In these two conditions, the resulting febrile action partakes of the character of the vital functions; being in the former generally open, well developed, energetic, or, to use an epithet very commonly employed by writers, inflammatory; in the latter, often feeble with deficient reaction, and a tendency to prostration, and, when the blood is at the same time depraved, with the addition of symptoms usually denominated typhous. The term inflammatory, as above used, is not entirely correct; for it is not intended to imply the existence of any positive inflammation. It only means that there is real strength or energy as well as excitement in the vital functions. Nay, inflammation is not at all incompatible with the contrary state; for we often observe it in cases of the asthenic, adynamic, or typhous form of the disease. It is necessary constantly to bear this distinction in mind, in the treatment of bilious fever; remedies being well borne and even required in the one case, which might prove in the highest degree dangerous in the other. In very many cases, it happens that the strength of system is in an intermediate state, being neither materially elevated above, nor prostrated below, the medium standard of health. The symptoms detailed immediately below are those of cases in which the vital powers are not materially depressed.

Symptoms.—For one or two days or more before the commencement of the fever, the patient is very often affected more or less with feelings of general discomfort, weariness, or languor, a sense of weight, fulness, or indescribable uneasiness at the epigastrium, deficiency of appetite, disordered taste, slight pain or uneasiness in the head, especially over the brow, and fugitive pains or soreness in different parts of the body. If the tongue is examined, it may appear slightly furred near the root, perhaps the pulse may be a little excited, and the complexion somewhat dingy or sallow. These symptoms, however, exist in various degrees in different cases, and some of them are frequently wanting. Sometimes they are felt, with or without alternating sensations of chilliness and warmth, at a particular time every day or every other day, with intervals of healthful feeling, until at length they deepen into regular paroxysms. During this preliminary period, the patient is going about, and engaged, though languidly, in his ordinary avocations. In many cases, no such premonitory symptoms are observable, and the patient is attacked in the midst of apparently good health.

The disease usually commences with sensations of chilliness, amounting often to rigors; and a slight coolness of the extremities is generally sensible to the observer. The face is usually pale, and the lips purplish. The pulse is small, depressed, and not unfrequently irregular. Occasionally, there are nausea and vomiting, thirst, and pain in the loins and extremities. The duration of the chill varies from a few minutes to an hour or more; but it is seldom so severe or long continued as in intermittent fever. Not unfrequently, the only sign of this stage is a sense of chilliness alternating with flashes of heat; while, to the by-stander, the surface feels uniformly warmer than in health. For some hours after reaction, the patient is frequently liable to this chilly sensation, upon every change of posture which brings his skin into contact with a cooler portion of the bed. When febrile reaction has been established, the patient feels uncomfortably hot, the skin is hot and parched, the surface generally somewhat reddened and expanded, the respiration hurried, and the pulse increased in frequency and fulness, and often also in force. At this stage of the complaint, however, the pulse is in ordinary cases not very frequent; being sometimes as low as 90 in the minute, and not often exceeding 116 or 120. It is usually open, well-developed, and sufficiently forcible, but not commonly very hard or tense. The tongue is almost always somewhat coated, but the fur is generally thin at this early period. There is a complete loss of appetite, amounting even to a feeling of loathing for food; sometimes with, sometimes without, nausea and vomiting. Thirst is a very frequent, though not constant symptom. The face is usually flushed, and the eyes suffused; and the patient almost always complains of headache, which is often severe, tensive, or throbbing, and is in most instances the source of greater suffering than any other cause. There are also frequently pains more or less severe in the back, loins, and extremities. Though seldom delirious, the patient is restless and wakeful. When not delirious, he is always sensible of great muscular weakness, and usually finds it necessary to keep his bed.

These symptoms continue without abatement, for a considerable time, usually from six to eighteen hours, after which they begin to relax, with the appearance of moisture about the neck and face. This gradually increases, until the whole body is covered with a gentle perspiration; and the patient now experiences so much relief that he often falls into a quiet sleep, from which he awakens refreshed, and apparently much improved. The headache, thirst, and nausea have greatly abated, or quite disappeared; the pulse has become almost natural; the skin is cool and soft; the tongue often shows a disposition to clean; and food is sometimes received, if not with relish, at least without disgust. This is the remission. It is frequently less complete than above described; but, in almost all cases of ordinary bilious fever, occurs in a greater or less degree. It is exceedingly variable in duration, in some cases lasting not more than two or three hours, in others a whole day; being shorter or longer according as the type of the fever may be quotidian or tertian. Another paroxysm of fever then takes place, sometimes, like the first, beginning with a chill and subsiding with perspiration, but frequently also without either the one or the other. This ends in due time in another remission; and thus the alternation continues, each successive exacerbation becoming, as a general rule, more severe and protracted, and each remission less decided and shorter, until the disease attains its maximum of severity; when, though in many instances the remissions are still distinct, yet it often happens that they are quite otherwise, and that the only evidence of fluctuation in the course of the fever is, that the pulse beats a few strokes less frequently, the skin is somewhat cooler, and the sufferings of the patient somewhat less, in the morning than in the evening. In this stage, the following symptoms are presented; and it may not be improper to repeat, that, in some cases, the disease starts into existence in this comparatively continuous form, and presents the symptoms alluded to almost from the outset.

The *pulse* is usually more frequent than at first, and occasionally much more so, being sometimes above 120 in the minute. It has also not unfrequently acquired increased tension and force, by the developement of inflammation in one or more of the organs. The *heat* and *dryness of the skin* have also been augmented. The *tongue* is now thickly and uniformly covered with a whitish or yellowish-white coating, which, as the disease advances, often becomes brown or blackish, especially in the centre. In moderate cases, the tongue is usually rather moist throughout the disease; but, in those of a higher grade, it not unfrequently becomes dry or dryish, and sometimes chapped or fissured upon the surface. It is occasionally disposed to be dry in the paroxysm, and to become moist in the remission. At the sides, where not covered with fur, it is usually red, and not unfrequently indented by the teeth, in consequence of being somewhat swollen. Sometimes the patient is troubled with uneasy sensations in the back part of the tongue, or in the fauces, which cause an almost constant hawking, with the discharge of a glairy mucus. The author well remembers that, in a severe attack of this kind, one of his most uncomfortable sensations, in a certain stage of the disease, was a feeling as if there were a loose hair in the fauces. In the great majority of cases, there is more or less *tenderness upon pressure in the epigastrium*. Sometimes this is excessive, so that the patient cannot bear with equanimity even the touch of the fingers. There is very frequently also a feeling of *weight* or *oppression* in the region of the stomach; and occasionally also a *burning pain*, which is in some instances almost intolerable. The epigastric tenderness and pain are not in general experienced, in any considerable degree, before the third or fourth day, and are apt to increase with the progress of the disease. They are among its most striking characters. With these symptoms, there is very often an irritable, sometimes an excessively irritable state of the stomach. *Nausea and vomiting* are very frequent attendants upon bilious fever. Though occasionally present at the beginning, they are more troublesome, as a general rule, when the disease is at its height. The matter ejected is usually of a yellowish, greenish, grass-green, bluish, or brownish colour, and a bitter, acrid taste; sometimes a glairy mucus; and, in many cases, whatever is swallowed. It is not unfrequently difficult to induce the stomach to retain either medicine or drink. The nausea is often so great as to produce some temporary weakness of pulse, and damp relaxation of the skin; and, when it is severe, the headache is diminished, and delirium, if previously existing, often calmed. It must not, however, be understood that nausea and vomiting are constant attendants on bilious fever. Many mild cases run their whole course without these phenomena; and, in some very severe cases in which disease seems to be concentrated in the brain, the stomach apparently escapes. The *bowels* are usually constipated, especially in the early stages; and it is said that purgatives sometimes act with great difficulty. This, however, does not correspond with my own observation. I have seldom found much difficulty in procuring free alvine evacuations; though it must be acknowledged that the bowels are much less readily operated on by medicines than in the enteric or typhoid fever. The *stools* are generally disordered, sometimes dark-colored and offensive, sometimes showing a deficiency of bile, but more commonly bilious, with some shade of yellow, green, or black. At a somewhat advanced period of the complaint, a bilious diarrhœa not unfrequently sets in, and dysenteric symptoms sometimes make their appearance. In some instances, looseness of the bowels exists from the commencement; and, as vomiting is apt to be present at the same time, the complaint is ushered in with a kind of cholera morbus. If worms exist in the bowels, they are generally discharged.

The *urine* is scanty, and often yellowish-brown, or reddish and turbid, and, in the latter stages, of a dark reddish-brown colour. Early in the disease, and in all stages when the paroxysmal form is very distinct, it has a tendency to become more copious in the remissions, and, though clear upon being discharged, to deposit a lateritious sediment upon cooling.

One of the most striking characteristics of the disease, though not present in all cases, is a *yellowish hue of the skin* and of the white of the eyes. This sometimes makes its appearance at the beginning, but more frequently not till about the third or fifth day of the disease. It is often uniform over the whole body, and before the close is sometimes very intense. In some bad cases, it assumes a dark or bronzed hue. Occasionally the yellow matter is thrown off upon the surface, so as to stain yellow a white handkerchief when rubbed upon the skin. It is said to be less intense, as a general rule, in those cases in which there is a copious bilious diarrhœa. Under the same circumstances, the urine is usually of a very dark yellowish-brown colour.

The *nervous system* also participates strongly in the disease. No symptom is more common or constant than *headache*. Very frequently it begins with the fever, and, though moderated in the remissions, does not wholly leave the patient during its continuance, unless removed by remedies. Along with the headache there is frequently vertigo, with singing or roaring in the ears; and occasionally intolerance of light or sound, beating of the carotids, redness of the conjunctiva, flushing of the face, &c., indicating a strong vascular determination to the brain, if not positive meningitis. The throbbing headache of the first paroxysms generally settles into uniform dull sensation as the disease advances; and the violent pains in the back and limbs become more moderate, or cease. *Delirium*, though not very frequent at the commencement as the disease ordinarily appears, is now apt to set in; generally, however, not with severity, showing itself rather by a confusion of thought, especially when the patient wakes from sleep, than by any violence of action or speech. Sometimes there is drowsiness or stupor, sometimes apoplectic or paralytic symptoms, and sometimes also tetanic spasms; but the two latter sets of symptoms are rare. I have seen a case of decided palsy of one side of the body, which yielded immediately to a copious bleeding. Another not unfrequent disorder of the nervous system is obstinate wakefulness, with restlessness and jactitation; and these may occur even in moderate forms of the disease. Hiccough is an occasional and very troublesome symptom, sometimes appearing early, but in general not till near the close.

Such are the symptoms which attend bilious fever when fully formed, and in the middle or somewhat advanced periods of its course. The student must bear in mind that they are not all present in the same case; indeed, some of them are mutually incompatible, and cannot therefore exist together; but all of them are so often to be met with that they could not be omitted in an account of the complaint. Various other incidental phenomena occur, which it is unnecessary to mention, as they are in no respect peculiar, and may take place in almost any febrile disease.

If the disease retain a distinct paroxysmal character, it generally runs on, when not interrupted, for two or three weeks, or more, terminating at last either by spontaneous solution at the end of one of the paroxysms, which goes off usually with a more than ordinarily profuse perspiration, or in a regular intermittent, or in a kind of low typhoid affection such as I shall describe directly.

If, as is more common in the somewhat severe cases, it approach the continued form, it generally advances, with more or fewer of the symptoms above enumerated, to some point of time between the seventh and fifteenth days, when it either declines, or ends fatally, or takes on a new character. When it is to terminate favourably, it either declines slowly from the culminating point, with a gradual subsidence of all the symptoms; or ends abruptly with a profuse perspiration, or with the occurrence of diarrhœa or diuresis; or changes into the intermittent form. The first and the last of these modes of termination are, perhaps, the most frequent. The first signs of a favourable change are usually a steady diminution in the frequency of pulse; a return of moisture to the tongue, with an obvious disposition in the fur to withdraw from the tip and edges; and a softer, moister, and cooler state of the skin. The one most to be relied upon, is probably the gradual cleaning of the tongue from its end and borders. Along with these signs of amendment, all the other phenomena of the disease gradually subside, and the patient enters into a convalescence which is apt to be permanent. When the disease goes off with a profuse perspiration, it has been observed that this is sometimes offensive to the smell. The diarrhœa, which occasionally appears to take the place of the perspiration, is usually bilious. Copious black tar-like discharges sometimes occur towards the close of severe bilious fever, and are considered as a favourable sign, especially in cases which have been attended with congestion and torpidity of the liver. A vesicular eruption upon the lips is apt to occur about the period of convalescence, and is also regarded as favourable.

In the immense majority of cases of bilious fever, recovery takes place in one of the above modes. But, in consequence of exhaustion following excess of excitement, or of disorganization produced by inflammation, or possibly from a loss or depravation of the vital properties of the blood, death frequently ensues in bad, and badly managed cases of the disease. Instead of the favourable symptoms above mentioned, as indicative of convalescence, others of an alarming character make their appearance. The pulse becomes more frequent, and at the same time smaller and more feeble, till at length it can scarcely be felt, and sometimes ceases entirely at the wrist some hours before death; coldness, beginning in the hands and feet, gradually extends upwards through the limbs, and even invades the trunk; the skin assumes a dusky, livid, or purplish hue, or, if yellow previously, becomes of a dark almost bronzed appearance; the extremities are covered with a clammy sweat; the tongue is dark-brown, clammy or dry, and sometimes chapped; hiccough not unfrequently occurs, sometimes with eructation of dark matter from the stomach; the abdomen is often tympanitic; black liquid matters, or dark blood, or a reddish serum like the washings of flesh, are discharged, often involuntarily, from the bowels; the urine is dark-brown, fetid, and scanty, or quite suppressed; the features are collapsed, and the eyes often of a turbid or muddy appearance; low delirium, followed by stupor or coma, takes place; and the patient passes, usually without consciousness, into the dying state. Death, under these circumstances, generally occurs between the seventh and fourteenth days of the disease.

In not a few cases, however, instead of following either of the courses above indicated, the disease, somewhere from the ninth to the twelfth day, takes on a new character, very much resembling that so frequently met with in enteric fever. All regularity in the recurrence of the paroxysms now generally ceases. The pulse becomes very frequent, often rising to 120 in the minute, and sometimes reaching or even exceeding 140, while it is small and rather feeble. The skin is dry, and either universally hot, or cold in some places and hot in others. The tongue is dry or dryish, often contracted, and of a brown or blackish colour. Sordes often collect about the teeth, tongue, and lips. The sufferings from nausea, vomiting, and headache, diminish, or cease. The bowels, though in some cases costive, are in others loose, with unhealthy discharges, dark, bloody, or dysenteric. The urine is scanty or suppressed, or is retained, producing sometimes great distension of the bladder. Stupor or low delirium, with subsultus tendinum, picking of the bed clothes, slipping down in the bed, &c., supersedes the former cephalic symptoms. Not unfrequently the patient thinks himself in a strange place, and, insisting upon returning home, sometimes rises from his bed, and sinks exhausted upon the floor. At length, if relief is not obtained, profound coma sets in, the pulse sinks to nothing, the surface becomes cold, the countenance assumes the hippocratic expression, and death speedily follows. When the fever takes on the character here described, it is often much protracted; sometimes running on for three or four weeks, or even longer. But, even in this form, it is very frequently curable. When it is about to take a favourable turn, the tongue becomes somewhat moist, and often, instead of cleaning from the edges and tip, throws off its fur in flakes first from the middle, or indifferently from any portion of the surface, which is left red and smooth, as if deprived of its papillary structure. Under these circumstances, convalescence may be expected, though it is always rather slow. In other cases, the tongue cleans in the ordinary manner, and then we may look for a more rapid recovery. Other favourable symptoms are the subsidence of delirium, the return of consciousness, and a more healthy condition of the various secretions. But the pulse often remains frequent for a considerable time after convalescence has commenced; febrile exacerbations occasionally take place; and the patient sweats much during sleep. Gradually, however, the system regains strength, the mischief done to the various organs is repaired, and health is at length firmly re-established. Even this form of the fever sometimes ends in intermittent, and thus proves that it was not, what it might otherwise be thought to be, a pure case of enteric or typhoid fever.

Modifications.—The above description applies to bilious fever in its ordinary forms. But few diseases are more protean in their character than this. It would be utterly impossible, within the limits to which we are confined, to detail the various appearances described by authors, as exhibited by the disease in different places, and under different circumstances. I shall briefly allude to a few of the more prominent varieties; merely premising that in all of them there are evident, in some of the cases, certain signs, either full blown, or as it were in the bud, which mark the disease as miasmatic or bilious fever; more especially gastric irritation, yellowness of the skin, and a tendency to the regular paroxysmal form.

Sometimes the disease starts at once into existence with alarming violence. After a slight chill, or without any chill whatever, the patient may be seized with excruciating pains in the head, back, and limbs, a feeling of stricture across the chest, exquisite suffering in the epigastrium, incessant and enormous vomiting of bilious matter, by which the head is somewhat relieved, unquenchable thirst, and quickly supervening yellowness of the skin and eyes; the pulse being either frequent or slow, and the skin hot or cool, without materially affecting the condition of the case. Persons similarly exposed with those attacked as above, are occasionally seized with violent delirium at the very outset, rendering them dangerous to others and to themselves. Seamen on board ship endeavour to jump overboard, though this may possibly be less from a disposition to self-destruction, than from an instinctive tendency to seek relief in the water. Sometimes the delirium is followed and relieved by the occurrence of the gastric symptoms already mentioned. After an uncertain duration, the violence of the attack subsides, and a remission follows, which gives way in its turn to a second paroxysm, and so on to the end. Notwithstanding the fierceness of the access, the disease frequently yields to remedies with great facility.

In the form of the disease above referred to, though there is great functional disorder in the encephalon, the stomach and liver appear to be the real centre of attack. In another form, it expends almost its whole force upon the brain. The patient is seized with coma, resembling almost precisely an apoplectic attack, though without paralysis. The face is red and turgid, the carotids throb, the pulse is full and strong without being very frequent, the respiration is slow and sometimes stertorous, and the pupils usually dilated. All the symptoms are those of strong determination of blood to the brain. After a certain continuance, a remission takes place, and the patient recovers his consciousness, to fall again at the regular period into the comatose condition. It is generally by the remission alone that the nature of the disease can be ascertained. Sometimes death ensues from disorganization of the brain. Sometimes a collapse takes place, with symptoms such as those already enumerated in fatal cases of bilious fever. The disease, however, often yields to energetic treatment. Occasionally there is paroxysmal stupor alone, without apoplectic symptoms.

Another and most frightful form of bilious fever is the collapsed condition, generally known in this country by the name of congestive fever, which will be treated of under a different head. It may be proper, however, to observe, in this place, that an ordinary attack of bilious fever may, without warning, take on the form called congestive; and, unless the practitioner is prepared for the event, will almost certainly prove fatal. The great danger is, that, when the patient is raised, perhaps with great effort, out of the paroxysm into which he has fallen, the practitioner may consider the amendment as the beginning of convalescence, and thus omit the measures necessary to ward off the death which is approaching with the subsequent paroxysm. The fact is mentioned here, in order that the young practitioner may be put upon his guard. Whenever, in bilious fever, a paroxysm occurs, of peculiar severity and danger, it should always be looked upon, when receding, as doing so only in order to return with increased and perhaps fatal violence. It does not follow that it necessarily must return in this manner; but it is always safest thus to regard it.

Bilious fever is often greatly modified by accompanying inflammation of one or more of the important organs. Perhaps the *stomach* is the one most frequently attacked. It is rare that a fatal case of bilious fever occurs, without some sign of gastric inflammation. The most striking evidences of such a condition, during life, are burning pain in the epigastrium, tenderness on pressure, and obstinate vomiting. Inflammation of the *bowels* is not uncommon. It occurs most frequently in the advanced stages, and is indicated by diarrhœa, tympanitic distension of the abdomen, and, when the sensibility of the patient is unimpaired, by colicky pains, and some tenderness on pressure. Dysentery is, in some seasons, frequently associated with remittent fever. The *liver*, though always functionally deranged, is not often inflamed. Hence, there is seldom pain upon pressure in the right hypochondrium, though this does occur in some cases. The *spleen* is occasionally painful and considerably swollen, as shown by the dulness on percussion below the margin of the left short ribs. Inflammation of the *lungs* is not common in autumnal fevers; but the pneumonia which follows these fevers in the winter is very apt to be complicated with symptoms of miasmatic origin. The probability is that, in some at least of these cases, there is a conjunction of pneumonia and bilious fever. The *encephalon* is often inflamed in some one of its parts. Most frequently the membranes are affected; and then we have severe headache, active delirium, vertigo and tinnitus aurium, intolerance of light and sound, and often contracted pupils, ending, if not relieved, in coma, and at length in great and fatal prostration. Occasionally, though much more rarely, the substance of the brain is separately the seat of inflammation. This may be suspected, when there is original and persistent stupor or coma, without typhoid symptoms. Sometimes severe *rheumatic pains* are coincident with bilious fever. I have known a patient with this disease to be confined for many days to one position upon his back, without the possibility of moving his body, in consequence of rheumatism of the muscles of the trunk. Under such circumstances, the spinal marrow may be suspected to be in fault.

Bilious fever is sometimes of a low, adynamic, or typhous character from the commencement. This may be the result of a previous exposure to causes calculated to depress the vital powers, and to deprave the blood; but it probably most frequently arises from the co-operation of a typhoid epidemic influence with miasmata. In such cases, connected with more or fewer of the characteristic symptoms of bilious fever before enumerated, are, at a comparatively early period in the disease, a dark and dryish tongue, with sordes about the gums and teeth; dark alvine evacuations, becoming in the end involuntary; flatulent distension of the abdomen; irregularity of respiration; a pulse either frequent or slow, slender or full, regular or irregular, but always feeble and readily compressible, and sometimes almost fluttering; a strong tendency to passive hemorrhage, as shown by oozing of blood from the gums, discharges of dark blood from the bowels, and petechiæ and vibices upon the skin; a dusky, livid, or purplish hue of the surface, often combined with the yellow of the bilious disease; irregular distribution of heat over the body; and the early occurrence of low delirium, stupor, or coma, or, in their absence, of great restlessness, jactitation, anxiety, and mental depression.

Authors have made varieties of bilious fever founded on the predominance of certain local symptoms, as the *gastric*, when the stomach is especially involved, and the *hepatic* when the liver is supposed to be prominently affected; but upon the same basis we might erect many other varieties, as the cerebral, the pulmonary, the intestinal, &c. This is a quite unnecessary complication of nomenclature, and might lead to the erroneous conclusion, that there was something essentially different in the character of the affections.

Duration.—The average duration of bilious fever, in all its forms, may be stated at about fourteen or fifteen days. It sometimes ends as early as the fifth or seventh, often about the ninth or eleventh day; and is sometimes greatly protracted, even to four weeks or more. In malignant cases, it sometimes destroys life as early as the third day or even earlier; but such instances are comparatively rare. Under appropriate treatment, it is often much shortened.

Convalescence.—In mild cases, the convalescence is often rapid and in all respects favourable. But in the severer cases, in which considerable organic injury has been inflicted on the system, or the vital functions have been greatly perverted or prostrated, the return to health is not unfrequently through a course of varied, and sometimes of very protracted suffering. The pulse remains frequent, the tongue more or less furred, especially about the root, the appetite languid, the digestion imperfect, and the bowels disposed to constipation or looseness. Copious sweats at night annoy the patient, and serve to maintain the weakness in which they originate. The nervous system is often deranged, as evinced by wakefulness or disturbed sleep, hypochondriacal notions, depressed spirits, neuralgic pains, &c. Sometimes enlarged spleen, and diseased liver are left behind, giving rise to dyspeptic symptoms, jaundice, dropsy, and various bowel disorder. When the appetite returns it is very often voracious, and much caution is necessary to guard against overtasking the yet feeble organs of digestion. Relapses are not uncommon.

Anatomical Characters.—As might be anticipated from the symptoms of the disease, various organs are often found, in different cases, to present signs of inflammation after death. Mucous gastritis is probably the most frequent lesion, and is discovered, in a greater or less degree, in most of the cases examined. But it is asserted to be sometimes wanting, and frequently so moderate in degree, as to be altogether insufficient to account for the phenomena of the disease.

The mucous membrane of the bowels is also often inflamed. Dr. Stewardson observed that the mucous glands of Brunner, in the duodenum, were developed in an extraordinary degree; but this is not a uniform lesion. Ulceration in the track of the bowels has also been noticed; but, of the numerous cases examined by Drs. Gerhard, Stewardson, and Swett, not one was found to exhibit inflammation and ulceration of the elliptical patches of Peyer's glands, such as characterize the enteric or typhoid fever. It is true that this lesion is said to have been noticed by others; but the accounts we have seen are too vague to be considered as authoritative. It is necessary to the formation of a proper judgment, that the course and symptoms of the case examined should be minutely recorded, at least sufficiently so to enable us to decide upon the nature of the disease. There is reason to believe that enteric fever has sometimes been mistaken for bilious or remittent fever, and lesions belonging to the former, placed to the account of the latter.

Signs of inflammation of the membranes of the brain, and of congestion of that organ, have been not unfrequently noticed. Sometimes also the lungs have been found inflamed, and still more frequently congested. The heart is sometimes softened and flaccid. But there is nothing peculiar to remittent fever in these phenomena.

The liver is often enlarged, and generally more or less softened; but unequivocal marks of inflammation are seldom found. The most striking phenomenon revealed by dissection is a loss of its natural reddish-brown colour, and the substitution of a bronze or slate colour, or of both variously mingled, upon the external surface of the organ, and of a uniform olive or light bronze upon its cut surfaces. The distinction between the lighter and deeper colours in the interior structure of the organ, existing in health, is no longer observable, or at least is much diminished. This alteration of colour was first distinctly described by Dr. Stewardson, of Philadelphia, in a paper published in the *American Journal of Medical Sciences*, for April, 1841 (N. S., i. 289); and has since been noticed by other observers, among whom may be particularly mentioned Dr. Swett, of the New York Hospital (*Ibid.*, ix. 29), and Drs. Anderson and Frick, of the Baltimore Almshouse Infirmary (*Ibid.*, xi. 312). It was found in all the fatal cases of remittent fever examined by these physicians, and may be regarded as one of the characteristics of the disease. It may possibly depend, as suggested by Dr. Stillé (*Ibid.*, p. 323), upon a distension of the biliary ducts with bile, and of the venous ramifications with blood; and this congestion will account also for the frequent enlargement of the organ. It should be stated that Dr. Boling, of Montgomery, Alabama, denies having met with this change of colour, in most of the cases which he has examined of fatal bilious fever, occurring in his vicinity. In a large proportion of cases, so far as he was able to judge, "the organ was entirely healthy;" and, when otherwise, it was only the concave surface that had changed colour, this being of a "uniform bluish-slate colour extending to about the depth of a quarter of an inch," with a well defined line of demarcation separating it from the unaltered part. (*Ibid.*, xii. 53.) Dr. Boling gives no detail of the symptoms, during life, of the particular cases of which he made post-mortem examinations. In almost all the cases in which the state of the gall-bladder has been noted, it was found full of a dark, sometimes almost black, viscid bile, not unlike molasses in colour and consistence.

The spleen is almost always enlarged, often to four or five times its healthy dimensions, or even more. It is also generally softened, so much so, in many instances, as to be pultaceous, and to resemble loosely clotted blood. Sometimes its colour is black, sometimes reddish, like the lees of red wine.

The blood in bilious fever, as drawn near the commencement of the disease, generally coagulates without presenting the buffy coat. At a more advanced stage, however, it often becomes buffy, and even cupped, probably in consequence of the developement of inflammation. Dr. Frick, of Baltimore, found the fibrin above the average of health in four out of five cases examined by him, and the red corpuscles to be increased in all but one. (*Am. Journ. of Med.*

Sci., N. S., xv. 30.) Meli discovered, in the blood of bilious fever, a considerable quantity of the colouring and fatty principles of the bile. (*Dict. de Méd.*, xv. 284.) In violent cases, it has been found partially disorganized, the colouring matter being diffused through the serum, and not separable by filtration. In malignant and typhous cases, it has sometimes been found black, and either wholly or partially uncoagulable.

Causes.—The essential cause of bilious remittent is probably the miasma which proceeds from marshes, &c. Many believe that, while produced by this cause, it may also proceed from others, especially a high degree of heat combined with moisture. If this were the case, why should we not see it originating in the midst of our cities, where the heat is intense, and moisture often abundant? Why does it not occur constantly among seamen, navigating equatorial seas, whether long from port or not? The fact is well known, that the crews of ships within the tropics remain free from the disease, so long as they keep at a certain distance from the shore. They may be affected with scurvy, dysentery, diarrhœa, and various phlegmasiæ; but they escape bilious fever. Let them, however, approach a miasmatic coast, and it often happens that almost the whole crew are seized with the disease. They are also often affected with it after leaving port, until the period during which the cause may be latent in the system is passed. It is true that instances are on record, in which the disease is asserted to have raged fearfully in barren islands, with little vegetation upon their surface, and offering no obvious source of these poisonous effluvia. But our information on these points is generally too vague to be relied on. We do not know whether some lurking source of miasmata may not exist, and have escaped a careless search. We cannot by any means be certain that the diseases alluded to were, in all instances, really bilious fever. They may have possibly in some instances been yellow fever, which has often been confounded with the bilious; they may have been in others merely gastro-hepatic or cerebral inflammations, or these mingled with a diseased condition of the blood, arising from impure and confined air, or other causes such as occasionally produce typhus fever.* It so frequently happens that communities escape bilious fever, though long exposed to excessive heat, if unattended with vegetable decomposition, and so seldom escape it entirely, when the latter cause is to any great extent conjoined with the former, that the few instances which have been adduced in contravention of the rule cannot but be looked upon with some suspicion; at least the inference is justifiable, that they might probably be reconciled to the rule, were all the circumstances accurately known.

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* Cases of this kind occurred in the city of Philadelphia, in the year 1821. The disease was confined to the black population of one of the filthiest portions of the city, and occurred at the commencement of the severe heats. It was of a most malignant character, and often carried off the patient on the fifth or sixth day. Along with the chill and subsequent reaction, common to all febrile diseases, there was a severe burning pain in the epigastrium, with great tenderness *at the commencement of the disease*; and the signs of gastric disorder were usually prominent throughout. But, along with this, were great depression of system, and the ordinary typhous symptoms of a dark tongue, low delirium, subsultus tendinum, coma, &c. Bilious vomiting and purging were very frequent; and, a yellow or muddy appearance of the conjunctiva not uncommon. A vomiting of black matter sometimes preceded death. Dissection revealed inflammation of the stomach, duodenum, and bowels; and the blood was in one instance completely disorganized, and incapable of coagulation. That this was not bilious fever, though attended with yellow eyes and bilious evacuations, and though the fever usually remitted somewhat in the first 24 hours, is evinced by the considerations, that it occurred in the beginning instead of the close of summer, among the blacks instead of the whites, and was in no case followed by an intermittent. It is very possible that such affections as the above, occurring in crowded garrisons, in hot climates, may have been mistaken for malignant bilious fever. See an account of the epidemic by Dr. G. Emerson, in the *Philad. Journ. of the Med. and Phys. Sciences*, iii. 193.

There cannot be a doubt, that remittent fever results from the same cause as the intermittent. The former probably occurs preferably to the latter, when the cause is highly concentrated and powerful, or the system of the patient peculiarly susceptible. Hence, intermittents are more common, relatively, in the cooler latitudes, at the commencement or near the close of the sickly season, in situations least exposed to the access of the poison, or when its source has begun to fail, and in persons who, from residence in miasmatic regions, are in some measure protected against it. Remittents, on the contrary, prevail most in hot climates, in the midst of the sickly season, in places where the exhalations are most abundant and have the best opportunity to act, and among individuals least protected by habit against their influence. (See *Miasmata*, page 153.)

Remittents sometimes appear to prevail epidemically, spreading over wide districts of country, which had previously been exempt. But, even under these circumstances, it is probable that the essential cause is the same. Certain seasons appear to favour the developement of miasmata; and a strong proof that, even in apparent epidemics, it is really these emanations that act is, that the disease still occurs in the latter part of summer, and in the autumn. We do not hear of epidemics of remittent fever in the winter. It has been observed that seasons in which long-continued drought, sufficient to destroy vegetation, is followed by great heat and rains, and those in which long-continued rains are followed by very hot and dry weather, are favourable to the prevalence of remittent fever.

There is no doubt that, as in intermittents, various causes may excite the disease sooner than it would have occurred under the influence of the miasmata alone, and that, with the aid of certain other causes, miasmata will often produce the disease, when without such aid they might have failed; but, in all cases, the miasmatic influence is necessary. In relation to these co-operating causes, it is unnecessary to add anything to what has been already said under intermittent fever. They are precisely the same in the two affections.

It is a singular fact, that the negro, though not entirely exempt from miasmatic fever, is much less liable to it, and, when attacked, suffers less from it, as a general rule, than the white. Hence, the coast of Africa, which is so fatal to persons of our colour, is favourable to the negro; and the latter lives and works in the rice fields of Carolina, at seasons when a single night spent among them would be death to his master. Persons who dwell in miasmatic districts are much less susceptible to the disease than strangers who incidentally visit them; and, after complete recovery from one attack of remittent fever, the visitor acquires, in a certain degree, the same comparative insusceptibility, or, in other words, becomes in some measure acclimated.

The period at which the disease occurs, after exposure to the cause, is very different in different cases. Instances are said to have happened, in which the poison has been so concentrated and powerful as to produce its effects immediately. Generally, however, it lies apparently dormant for a period varying from one to two weeks, and sometimes much longer. It is no uncommon event for persons, coming into our northern cities from miasmatic regions, to be attacked with remittent in the winter, though they may have escaped during the previous summer and autumn. I have repeatedly witnessed such cases among the students of medicine, who attend the Philadelphia schools in the winter.

Nature.—The opinion which referred all the phenomena of bilious fever to gastritis scarcely requires to be combated, now that it no longer meets with supporters. Another and more plausible view is that which considers the disease as the superaddition, to intermittent fever, of acute inflammation of one or more of the organs, especially the stomach, liver, or brain. A constant symptomatic fever is sustained by the inflammation, which is conjoined with that of the intermittent disease during the paroxysm, but exists alone in the remission. It is highly probable that cases of this kind do occasionally occur; that an intermittent does sometimes assume the appearance of a remittent, by the intermixture of one of the phlegmasiæ. But that remittents generally are not of this character is evinced by the fact, that in many instances no inflammation whatever can be shown to exist early in the disease, even when the fever is most continuous; and that, when gastritis or encephalitis occurs, it is almost always as a secondary disease, making its appearance several days after the commencement of the attack. Not unfrequently, indeed, mild cases run their whole course, without signs of any local affection sufficient to induce fever.

Remittent fever has been considered by some as identical with the enteric or typhoid fever; but it is difficult to conceive how this opinion can be entertained by persons familiar with the symptoms and course of the two affections. In their marked and characteristic forms, they are strikingly different; as will be shown when the latter disease is especially treated of. It is true that there are cases of remittent fever, which, at certain periods of their progress, are not readily distinguishable from the enteric. Such, especially, are those in which bilious fever assumes a typhoid form in its advanced stages. But it is not impossible, and, as appears to me, not improbable, that the two diseases sometimes coexist. The causes of both, operating at the same time, may be readily supposed to produce a sort of mixed or mongrel affection; and this may be the case with the form of bilious fever just referred to.

Miasmatic fever differs from other forms of fever, in consequence of something peculiar in the operation of its cause. What this peculiarity is cannot be certainly determined, in the present state of our knowledge. The information derived from post-mortem examination does not greatly aid us. The lesions are the same as those frequently met with in other febrile diseases. Inflammations of the stomach, the bowels, the brain, &c., are common attendants on fevers. Nor is the softening of tissue, as of the gastric mucous membrane, the heart, the liver, and the spleen, which has been noticed in fatal cases of bilious fever, peculiar to that disease. It is found wherever the blood has become so depraved as to be unable properly to support the nutrition of the organs. The only peculiarity which has been discovered is the colour of the liver. How far this may be connected with the peculiar and distinctive pathology of the disease, it would not be easy to determine. It is probably the result of an over-production of bilious matter in the system; and this would appear to be one of the direct and peculiar effects of the cause. It is not in bilious fever, as in jaundice, that the liver does not act, and that the biliary principles being thus prevented from escaping by their usual outlet, accumulate in the blood, and are then thrown off by the skin. On the contrary, though there may be cases in which the liver is congested beyond the power of secretion, yet, in the great majority, that organ acts even more vigorously than in health, as is evinced by the bilious vomiting, bilious stools, and abundance of bile found in the gall-bladder after death. Whence then proceeds the yellow colour of the surface, and the jaundiced condition of the urine? Undoubtedly, from an excessive production of the biliary principles in the blood. These principles have been detected in the blood by chemical examination. They are produced in it probably through the agency of the cause, and, being injurious in this excess, seek an escape through all the emunctories, not the liver only, but the skin, kidneys, and possibly also the mucous membranes. There is reason to believe that the yellow colouring matter at least results from a change effected by this agency in the red corpuscles; and hence the striking deficiency of that ingredient of the blood in protracted cases of miasmatic fever. Still, this excess of bilious matter in the circulation is only one of the peculiarities of the disease. It cannot be the only one; for such an excess frequently exists without producing remittent fever. Can its elimination from the blood have anything to do with the cure or prevention of the disease? Can it be in this way that calomel acts? Very often an attack of remittent fever is preceded by symptoms of epigastric uneasiness, which indicate portal congestion. There is some reason to think that a spontaneous attack of cholera morbus at this period, or the somewhat similar operation of a full dose of calomel, occasionally prevents the developement of the fever. Can it be by carrying out of the system the excess of the biliary principles, which may have been accumulating in the blood, and which may have been stimulating the liver for a time beyond the secreting point, that the agents alluded to produce the effect ascribed to them? Perhaps, in thus turning our attention to the blood, we are entering upon a track which may at length lead us at least nearer to the truth. The peculiar disposition of the morbid effects of miasmata to assume the regular paroxysmal form remains to be explained. Nothing at present known yields us the least aid upon this point. We may consider, as the source of periodicity, the diurnal changes in our system consequent upon the alternation of sleeping and waking; but we can give no reason why miasmata should elicit the effect more than any other cause.

Diagnosis.—Little need be said upon this subject here. The diseases with which bilious fever may be most readily confounded will be treated of hereafter; and the means of diagnosis will be better understood, after the reader has become acquainted with their symptoms. Besides intermittent, of which enough has been already said, the complaints which are most likely to be confounded with bilious fever are the enteric and yellow fevers. To these the reader is referred. But there are certain phlegmasiæ with which the disease might, without care, be similarly confounded. Such especially are gastritis and duodenitis, when connected, as they often are, particularly the latter, with functional disturbance of the liver. Here the paroxysmal form of bilious fever comes to our aid, and very frequently of itself enables us to reach a just conclusion. The following may be considered, in a general way, as the most characteristic phenomena of remittent fever:—1. the regular paroxysmal character, and disposition to begin and to end in intermittent fever; 2. the epigastric uneasiness and irritability of stomach, so prominent in many instances throughout the complaint; 3. the almost constant symptom of pain or uneasiness in the head; and 4. the evidences of excess of bilious production, exhibited in the vomiting and purging of bile, the yellow skin and eyes, and the jaundiced urine. But the student must be upon his guard not to expect all these symptoms in every case of the disease. Other circumstances, which will materially aid the diagnosis, are the season of the year, the place where the disease may have been contracted, the exposure of the patient, and the length of time that may have elapsed since the exposure. Thus, if the fever appear in August or September, originate in a miasmatic district, and make its appearance from one to three weeks after the patient has been obviously exposed to miasmatic influence, the inference would be very much in favour of the conclusion, that it is a bilious remittent.

Prognosis.—This is generally favourable. The milder forms of the disease almost always end in recovery unless mismanaged, and the severest often yield to prompt and suitable treatment. There is, perhaps, no disease, in which the resources of our profession are more happily displayed than in the worst forms of bilious fever. Fearfully fatal under neglect or mismanagement, they may very often be conducted by proper treatment to a favourable issue.

Simple cases are usually less dangerous than such as are complicated with inflammation; those distinctly paroxysmal than the more continuous; and those attended with a vigorous or sthenic state of system, than the low, typhous, or malignant. In acclimated persons, the danger may generally be considered less, other circumstances being equal, than in the unacclimated; in the negro than in the white; in the temperate than in the intemperate; in those previously healthy, than in the diseased and debilitated. Signs of an approaching favourable change are a short or postponed paroxysm, a greater or longer remission, the occurrence of perspiration as the fever subsides, a disposition in the tongue to clean, and a general diminution of the other symptoms, as the frequency of pulse, heat of skin, headache, and gastric irritation. The opposites of these signs are of course unfavourable, but do not by any means uniformly indicate great danger. Among the really alarming and often fatal symptoms are great frequency of pulse, permanent coldness of the surface, low delirium or coma in the advanced stage, excessive subsultus, hiccough with eructation of black matter, hemorrhage from the bowels, involuntary evacuations, suppression of urine, and the hippocratic countenance.

Treatment.—It does not often happen that we see the patient in the cold stage; which, moreover, is in general too brief, and in other respects inconsiderable, to require treatment. Sometimes, however, it is unusually prolonged, and the system unusually depressed, so that the intervention of remedies becomes desirable. Under these circumstances, the case may be treated in the manner recommended in the cold stage of intermittents.

After reaction, attention should, as a general rule, be first directed to the alimentary canal. At one time, it was strongly recommended to begin the treatment with an *emetic;* and some still adhere to the practice. But, though in some instances this class of medicines appears to exercise a favourable influence upon the fever, moderating the frequency of pulse and heat of skin, and calming cerebral excitement, yet, in others, it aggravates existing irritation of stomach, and perhaps determines the supervention of gastritis. This danger is generally thought to outweigh the probable advantage, and emetics have, therefore, fallen into comparative disuse. There is, however, one condition, early in the disease, which occasionally justifies and even demands their employment. Allusion is had to the presence of irritating substances in the stomach. These produce all the evil effects of emetics, and more continuously. The indication, therefore, for their evacuation is obvious. The offending matters are undigested substances that may have been swallowed, or acrid accumulations in the stomach from chemical change, perverted secretion, or regurgitation. The former may be supposed to exist when the attack has come on very shortly after a full meal, or after indulgence in unwholesome food or drink. The presence of the latter is indicated by a feeling of epigastric oppression, severe nausea, and frequent but ineffectual efforts to vomit; the patient now and then discharging a mouthful of very sour or sharp colourless fluid, or of bitter and acrid bile. In either case, a gentle emetic is of great use, sometimes putting an end at once to the oppression, sickness of stomach and retching, and either preventing gastric inflammation, or causing it to be less severe.* Ipecacuanha is generally preferable, for this purpose, to tartar emetic, as it accomplishes the same object with less irritation. The emetic should be assisted by draughts of warm water, or warm chamomile tea, which serve more effectually to cleanse the stomach. But, should the signs be those of existing gastritis, as burning pain in the epigastrium, tenderness on pressure, and the discharge merely of drinks that may be swallowed, an emetic could do nothing but harm. In the great majority of cases, it may be safely, and perhaps advantageously dispensed with.

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* I would especially call the attention of the reader to the fact, that these remarks apply to the early stage of the disease.

An active *cathartic* is almost always indicated. Either the portal circulation, including that of the liver, is congested, or the bowels are loaded with fecal and bilious accumulations, which act as a constant source of irritation and discomfort. Depletion, and derivation from the brain, are also desirable in this stage of the disease. On all these accounts, it is proper to give a full dose of purgative medicine. Calomel is beyond comparison the best adapted to the case. It remains better than most others upon the stomach, and has a special tendency to act upon the liver, the secretory function of which it promotes, and thereby unloads the portal circle, while it also tends to free the blood from the biliary matter which may have become redundant in that fluid. Experience, moreover, has almost universally pronounced in its favour. From five to fifteen or twenty grains of it may be given alone, and followed, in six or eight hours, by half an ounce or an ounce of sulphate of magnesia, or other saline cathartic; or it may be administered in combination with some other purgative, as rhubarb, jalap, or compound extract of colocynth; eight or ten grains of each being given for a dose. Three or four of the compound cathartic pills of the U. S. Pharmacopœia, will also answer admirably well in many cases. Should the bowels not yield to these medicines, and especially if the stomach should be at the same time irritable, I know nothing better than the infusion of senna with Epsom salt, manna, and cardamom or fennel seed, of which a small wineglassful may be administered every two hours till it operates.* Sometimes, when the bowels are extraordinarily obstinate, or the stomach very irritable, it becomes necessary to have recourse to purgative enemata. (See *Colic.*)

The cathartic should be given, whether the patient be seen first during the paroxysm, or the remission. It will sometimes be better received by the stomach, and operate more kindly, in the latter state than in the former. Should the patient be unable to take calomel, as sometimes happens, in consequence of an idiosyncrasy which causes this medicine to occasion excessive pain in the stomach and bowels, the mercurial pill may be substituted, in the dose of ten or fifteen grains, combined with extract of jalap, rhubarb, &c.

After the bowels have been thoroughly evacuated, it will be sufficient, as a general rule, during the remainder of the complaint, to keep them open once or twice daily. This is often effected by the medicines which are given for other purposes. If not, half an ounce or less of sulphate of magnesia, sulphate of soda, tartrate of potassa and soda, or other saline purgative, four fluidounces of solution of citrate of magnesia, a Seidlitz powder, a drachm of magnesia, or three or four fluidrachms of castor oil, may be given as circumstances seem to require. Sometimes it will be more convenient, and answer equally well, to effect the object by means of enemata.

Another remedy, sometimes of great importance in the early stage of bilious fever, is *bleeding*. There are, however, many cases in which it is altogether unnecessary, and many in which it is positively hurtful. When the powers of life are feeble, or the system depressed by the co-operation of sedative agents with the main cause of the disease, it may even prostrate below the point of reaction. This is especially the case in tropical climates, where the continued influence of heat produces habitual relaxation, and fatal collapse in bilious fevers is not uncommon. The same may also be the case with persons debilitated by previous disease, or by intemperance, and in whom a typhous influence is operating, conjointly with the miasmatic. Bleeding, therefore, must not be indiscriminately resorted to. It is wholly powerless in the eradication, or even in the control of the febrile movement. The force of the pulse may be reduced, and the strength of the body exhausted, and yet the fever shall not have abated an iota of its violence, or its duration. The only legitimate object of venesection, in remittent fever, is the prevention of organic injury from inflammation, or local determinations of blood. But, as these are frequently the immediate cause of death, it is of great importance to be able to control them; and bleeding is among our most efficient means for this purpose. Hence, the indication for this remedy is the existence of inflammation, or of some active sanguineous congestion. But, though these constitute indications, there may be others which more than counterbalance them, and bleeding is not always admissible even in cases of inflammation. This may exist in connexion with an asthenic, as well as a sthenic state of system; and it is very possible, in the former case, that, in attempting to reduce the local disease, we may exhaust the little remaining strength, and thus disable the system from supporting the course of morbid actions, requisite to the restoration of health. There must, therefore, be not only inflammation, or threatening active congestion, or a reasonable fear of them; but also sufficient strength to support the system through the disease, after the blood has been lost.

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* ℞.—Sennæ ℥ss; Mannæ opt., Magnesiæ sulphat. āā ℥j; Cardamomi, *vel* Fœniculi, contus. ʒij; Aquæ bullient. Oj. Fiat infusum.

Blood may be taken from the arm, in patients previously healthy and of vigorous constitution, when the pulse is full, strong, and tense, the face flushed, and the pain in the head considerable; and especially when these symptoms persist after the free operation of a purgative. When intolerance of light and sound, active delirium, coma, or hemiplegia is superadded to the above symptoms, the indication is still stronger; and no time should be lost in having recourse to the remedy. The same may be said of cases in which the signs of inflammation of the stomach, liver, or lungs, are conjoined with a strong excited pulse. Great relief is sometimes speedily afforded to these local symptoms by the loss of blood. From twelve to twenty ounces may be taken at once; the caution being always observed to stop the flow as soon as a decided impression is made on the pulse, or any marks of faintness appear.

There are two conditions, sometimes occurring in remittent fever, which demand the loss of blood, though this may at first sight appear to be contraindicated. One of these is the complication of acute gastritis with excessive nausea, which, by repressing the force of the pulse, and producing coolness and relaxation of the surface, suggest the idea of great prostration, when, in fact, the vital energies are unimpaired, and the apparent depression is the effect of excessive irritation of one of the vital organs. It is highly important, under such circumstances, to be able to detect the real state of the disease through the mask of debility. If such a condition occur early in the case, if, upon the occasional subsidence of the nausea, the pulse resume its force, and the skin its febrile temperature, if burning pain or great tenderness in the epigastrium clearly reveal inflammation of the stomach, and if, finally, the colour of the surface do not indicate the existence of depraved blood, and malignant or typhoid debility, it may be taken for granted that bleeding is called for, and there should be no hesitation in resorting to the lancet. Not unfrequently the nausea will be found to diminish, and the pulse to rise, as the blood flows. The latter event may be considered as a clear proof that the remedy was indicated. In doubtful cases, it may be proper to bleed cautiously, stopping the orifice after taking a few ounces to ascertain the effect, and, if the pulse be found to flag, and the apparent prostration to increase, then to abandon the measure altogether; but, under opposite circumstances, to resume it, and continue till the requisite quantity has been lost.

The second condition is associated with inflammation of the brain. Sometimes, in connexion with cerebritis, the general organic actions of the system flag, in consequence of the interference of the disease with the functions of the great nervous centre, which exercises in health a controlling and supporting influence over most of the vital operations. Besides the stupor or coma which marks the cerebral disease, there is a small, feeble, and irregular pulse, with an uncertain temperature of the surface, which might lead to the inference of debility, were the practitioner not upon his guard. As in the last mentioned case, the stage of the disease, and the general signs which indicate the state of the blood, may lead to the suspicion, that the apparent debility is nothing more than a depression produced by the local inflammatory affection. Here bleeding should be tried with the same caution as in the preceding case, being abandoned if the pulse should flag further, and persevered in, if found to increase the vigour of the circulation.

In either of the cases above mentioned, it may be proper by sinapisms to the epigastrium or extremities, hot pediluvia, or rubefacient frictions, to call off excitement from the diseased organ, and rouse the circulation, both cardiac and capillary, before resorting to the lancet, or in conjunction with it. Not only may the nature of the case be thus more clearly developed; but the vital actions may be supported under the loss of blood, until time shall be allowed for the oppressed organ to resume its function, after the removal of its load. For the same reason, in those cases of depression dependent on or connected with nausea, opium may be employed to relieve this condition, preparatory to the use of the lancet.

It is usually not in the very onset of the disease that the indications for bleeding are most strongly presented. The first paroxysm is often less violent than those which follow; and, when inflammation takes place, it is generally two or three days, or even longer, before unequivocal signs of it are presented. Whenever they are met with, whether in the first or in subsequent paroxysms, along with the condition of the pulse referred to, then it is that bleeding should be employed; but it must be remembered that, in the advanced stages, the system has often become so exhausted that even the existence of inflammation is not a sufficient warrant for the use of the lancet. In all such instances, the requisite depletion may be more safely effected by leeches or cups in the vicinity of the organ affected; and the subversion of the disease must be left to other means than the mere loss of blood.

It is seldom that more than one full bleeding is required in bilious fever. A moderate tentative bleeding, of six or eight ounces, may often be advantageously repeated; but, after the loss of twelve, sixteen, or twenty ounces of blood, or, it may be, in robust and plethoric men, as much as thirty ounces, whatever more is done in this way should be accomplished by local depletion.

After the evacuation of the primæ viæ, and the use of the lancet, if that may have been considered advisable, *diaphoretics* come in with great advantage. Some authors speak slightingly of these remedies. But, when we consider that nature very often brings about a partial or complete solution of the paroxysm of fever by sweating, the inference appears very reasonable, that we shall favour this result by promoting her own favourite process. Nor do I think that experience is opposed to this conclusion of the judgment. It has always appeared to me that diaphoresis, brought about by proper means, the dose of twenty or thirty grains, dissolved in a fluidounce of water, in place of the draught, though much less agreeable, and less calculated to correct nausea.

Solution of acetate of ammonia, or the spirit of mindererus, is much esteemed by some practitioners; but, after frequent trials with it, I have found it in all respects inferior to the preparations of citrate of potassa.

In the advanced stages of the disease, or in asthenic cases, and especially in those associated with rheumatism, the *powder of ipecacuanha and opium* (Dover's powder), given in doses of ten grains, repeated every six or eight hours, is often an excellent remedy, operating most happily at once as a diaphoretic, anodyne, and gentle stimulant.

The *warm bath* is sometimes serviceable, in connexion with diaphoretics, in inducing relaxation of the surface. It is especially adapted to the cases of children.

The *external application of cold water* is also highly beneficial, in the febrile exacerbations. Much comfort will be afforded by simply sponging the arms, feet, and face; but a more efficient method of application, in reference to a solution of the paroxysm, is that of affusion, as recommended by Dr. Currie of Liverpool. Dr. Dickson, who has had much experience with this remedy, considers it as an efficient and safe substitute for the lancet, and recommends it in the strongest terms. In relation to the mode of using it, he says: "Seat your patient in a convenient receptacle, and pour over his head and naked body from some elevation a large stream of cold water; continue this until he is pale or his pulse loses its fulness, or his skin becomes corrugated and he shivers." He is then to be dried and replaced in bed. The surface is then completely relaxed, and a copious perspiration often follows. The remedy should be employed only when the surface is universally hot and dry, without any sense of chilliness on the part of the patient. It is not applicable, according to Dr. Dickson, to patients of "feeble habit of body, much advanced in age, or much exhausted or enfeebled at the time," nor to cases attended with oppressed or inflamed lungs, or with diarrhœa. Should it occasion protracted chilliness and rigors, with continued discomfort to the patient, it should not be repeated. (*Essays on Pathology and Therapeutics*, i. 302.)

In mild cases of remittent fever, few other remedies will be required besides those above detailed. When the remissions are very distinct, and approach the character of intermissions, the cure may often be greatly hastened by the use of quinia, as will be stated more fully in a subsequent page. But violent and threatening cases demand additional treatment.

Mercury has enjoyed a very high and merited reputation in this disease. It has been frequently observed that few patients die of bilious fever, whose systems have been brought under the influence of this remedy. The reply, indeed, has been made to this argument in its favour, that those cases only are susceptible to the action of mercury which can be cured by other means, or would get well spontaneously. But this is obviously assumption. Nor is the statement true. In cases which run their course in a few days, it is sometimes impossible to affect the mouth; but these are by no means the only dangerous cases, nor indeed the majority of them. In most instances the disease advances to the ninth day, or beyond it, before proving fatal. Of such cases, there are very few in which the mercurial influence cannot be established; and the inference is, that, were proper attempts made to establish it, very few would end fatally. Another argument against the use of mercury is its liability to produce serious and even dangerous disease of the mouth. This very rarely happens when the remedy is properly managed. I have never, in my public or private practice, witnessed a case of deformity or death from this cause. It is true that, from idiosyncrasies, patients are sometimes violently affected by the medicine, however carefully employed. But this is no reason for abandoning its use altogether. There is no efficient remedy of which the same may not be said. Death has often resulted from erysipelas following wounds; but patients are not on this account to be deprived of all the advantages resulting from the knife of the surgeon.

Mercury is, after the lancet, infinitely the most powerful antiphlogistic remedy in our possession. Now most fatal cases of bilious fever probably become so, in consequence of the disorganizing effects of the inflammations that attend them. Yet such is the state of the system, that bleeding very frequently cannot be safely pushed to the point necessary for the eradication of these inflammations. Mercury is sometimes, under these circumstances, our only refuge. But it probably does good in other ways. By stimulating the liver, it aids the system in throwing off the biliary matter which may offend it. The supposition is highly probable, that it otherwise alters the blood so as to render it less pernicious in its influence upon the functions. But, whatever may be the explanation of its action, the fact of its beneficial influence rests upon experience. I will only adduce a single fact, out of thousands which might be advanced in its favour. In the year 1804, the crew of the Centurion, a British ship of war, lying in the harbour of Bombay, were attacked in great numbers with a very violent form of bilious fever. The disease came on either with great distress in the epigastrium, and violent bilious vomiting, or with severe cephalic symptoms, amounting sometimes to furious delirium. Bleeding was not employed in a single case; but calomel was given freely, and generally with the effect of inducing ptyalism. Out of one hundred and fifty cases not one was lost. (*Dict. de Méd.*, v. 279.)

It is not necessary to give mercury in all cases of bilious fever. The great majority will do well without it. But, when the disease is violent from the outset, and does not soon show a disposition to yield to the remedies employed, or when it assumes a dangerous aspect in its course, there will always be a propriety in administering it in reference to its constitutional effects. The existence of considerable inflammation, whether in the stomach, brain, lungs, liver, or spleen, which cannot be speedily conquered by direct depletion, always affords an indication for its use. In the low or typhous forms of the complaint, when the lancet is inadmissible, it is a most valuable resource. The large quantities in which it has been sometimes employed are altogether unnecessary. Only a certain amount of it can find access into the system from the alimentary canal, and all the rest is either inert, or only a source of irritation. It is not necessary to interrupt the treatment already detailed. Calomel, or the mercurial pill, may be given in alternation, or conjointly, with the other remedies. The former preparation is best adapted to the early stages of the disease. From half a grain to two grains may be given every hour, two, or three hours, according to the urgency of the symptoms, and the known susceptibility of the patient. Let not persons accustomed to enormous doses of this medicine smile at those here mentioned. Let them first try even the smallest dose, in a sufficient number of cases, and determine, from the results of their experience, whether it may not be sufficient. When the stomach is very irritable, doses of only one-sixth of a grain, given every half hour or hour, and persevered in, will often have a more decided constitutional effect, than fifty times the quantity. The influence of these small doses, in calming bilious vomiting, is often most delightful. Should the bowels be very irritable, it will generally be advisable to combine the calomel with opium, and especially in the advanced stages. The medicine should be given regularly through the day; but should be omitted during six or eight hours at night, in order that the rest of the patient may be as little disturbed as possible. It is often proper to administer a somewhat larger than the ordinary dose at bedtime, with a grain or two of opium and the same quantity of ipecacuanha, if these be not contraindicated, the former by the state of the brain, and the latter by irritation of stomach. The refreshing effects of sleep are thus obtained, and the patient frequently awakens in a fine perspiration in the morning.

Calomel has been frequently administered in combination with tartar emetic and nitre, in the form of the nitrous powders. This is no doubt often an efficient remedy; but all its effects may be obtained more agreeably, and less offensively to the stomach, by the mercurial alternating with the effervescing draught, as before recommended. When the system obstinately resists the mercurial impression, or the case is very urgent, recourse should be had also to the external use of the remedy, in the form of the mercurial ointment, which may be applied by friction, or to blistered surfaces.

The effects of mercury upon the gums should be watched for with great care; and, as soon as any evidence of its action is afforded, the remedy should either be diminished or suspended, unless in cases of an almost desperate character.

Sulphate of quinia is another all-important remedy, in the treatment of certain cases of bilious fever. It has before been stated that, in ordinary cases, it will often shorten the duration of the disease, if given in the remission, after this has become decided, so as to approach an intermission. Should no signs of cerebral or gastric inflammation be present, and the activity of the circulation have subsided or been subdued, this medicine may be ventured upon whenever the remission has the character above mentioned. From twelve to eighteen grains, given in divided doses during the remission, will often be sufficient to prevent the paroxysm; and if not, a repetition of the same amount in the next interval will rarely fail. There are some who advise this treatment, in all cases of bilious fever, whether with very obvious remissions or not. Nay, they go so far as to maintain that the medicine may be given without any reference to exacerbation or remission, being as little injurious in the former as in the latter. But, though I believe that there has been much of prejudice in the disinclination of medical men to use quinia under any other circumstances than those of complete intermission, a prejudice probably derived from the unpleasant effects produced by the powdered bark when given during the existence of fever, yet I am not prepared to relinquish the old opinions as to the tonic and excitant properties of this medicine, and cannot but think that it may do much harm, if administered under circumstances of high arterial excitement, especially when attended with inflammatory tendencies of the brain. I am certain that I have seen it, in the large doses in which it has been recommended in remittents, give rise to serious injury by fixing inflammation; and one fatal case of this kind came under my notice in the Pennsylvania Hospital. It is the brain, in which most evil is to be apprehended from the abuse of quinia; because it is upon that organ that it operates most powerfully. That it should occasionally diminish the frequency of the pulse in febrile cases, is no proof of its essential sedative nature. Whatever cramps the functions of the brain, whether by over-stimulation or by depression, will have this effect. Opium in large doses often produces it. Yet opium is the last remedy we should think of employing, in inflammatory or active congestive tendencies of the brain; and for the same reason, we should avoid quinia under similar circumstances, unless there were some danger to be averted by the use of it, greater than that of the apprehended cerebral disease.

But there are circumstances in bilious remittent fever which render quinia of the utmost value. When a paroxysm of great violence has occurred, from which the patient has been saved only by the most strenuous exertions, and there is every reason to fear that a similar one will prove fatal, recourse should be had to the sulphate of quinia, in the remission, however imperfect or short it may be. When the fever has hitherto shown little or no tendency to remit, and the grade of violence is such that fatal results appear imminent, should the slightest remission show itself, and the symptoms not be those of cerebral inflammation or strong determination, the quinia should be poured in without stint. The more nearly a case approaches to the above extremes, the stronger is the indication for the use of the antiperiodic medicine. I am entirely confident that I have seen lives saved by this treatment, which must have been inevitably lost under any other. The quantity of quinia, given in the remission, must be sufficient to bring the system under the influence of the medicine, if possible, before the period for the next paroxysm. So far as my observation has gone, from eighteen to twenty-four grains are sufficient, in any case not falling under the title of malignant or pernicious; and often less will answer. The doses must be regulated by the length of the remission. If this be short, they must be very large, and if of a few hours' duration only, the whole quantity must be taken in two or three doses. If the remission be long, the medicine should be equally distributed through it, care being taken that the whole shall have been administered two or three hours before the expected paroxysm. The reader must not be led into the error of supposing, that the dangerous paroxysms above alluded to are characterized by excessive febrile excitement. On the contrary, there is often no remarkable degree of heat of skin, headache, or strength of pulse. The condition is rather marked by an extreme general distress, which the patient finds it impossible to describe, incessant jactitation, a feeling of burning heat while the extremities may be cool to the observer, incessant vomiting, great frequency of pulse, &c. When these subside into a comparative calm, then is the moment for the administration of the quinia.*

Nor should we be content with preventing a single paroxysm. The disease may be of the double tertian type, or may have a tendency to pass from the quotidian into the tertian. The remedy should, therefore, be continued until two daily paroxysms have been prevented; after which the patient may be considered safe.

In the more regular paroxysmal forms of remittent fever, should quinia fail, or its use not be deemed advisable, the succession may often be effectually broken by an *emetic*, administered so as to be in full operation at the time of the expected paroxysm. For this purpose, tartar emetic would probably be more effectual than ipecacuanha, though I have seen the latter entirely successful, in several instances, when combined with six or eight grains of calomel. A *pair of blisters* upon the legs or arms, applied so as to be in full action at the time above referred to, will often have the same effect. This remedy was very much employed before the introduction of quinia into use. *Sinapisms* operate in the same way. A full dose of opium, also, given in anticipation of the paroxysm, will occasionally prevent it. When employed for this purpose, it should be combined with an equal weight of ipecacuanha.

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* The question has been asked, why, if quinia is thus recommended in the violent cases as the most efficient remedy, it should not be employed also in the milder, in which it would probably prove still more effectual. I am not disposed to deny that many mild cases would yield to the remedy, employed even in the early stages, and without reference to remission or exacerbation. Indeed, I cannot refuse credence to the many statements to this effect which have proceeded from highly respectable sources. But, though it may often prove useful, it sometimes confessedly fails, and sometimes, I believe, produces evil effects by fixing, if not determining some inflammatory affection, especially in the brain, upon which it often acts so powerfully. Such a risk may very properly be incurred in cases of great danger from other sources; though it might be improper to incur it in mild cases, which may almost always be carried to a favourable issue without it. I think it not improbable that the influence of a warm climate upon the system may be such as to render it tolerant of quinia, under circumstances which have been generally supposed to contraindicate its employment; and a similar influence may be exerted by epidemic constitutions within particular limits; so that testimony in its favour should not be disregarded, even though contrary to our preconceived opinions, and even to our particular experience. (*Note to the second edition.*)

When the disease has originally a typhous character, or sinks into that state in its course, the same remedies must be employed as in the proper typhus. (See *Typhus Fever.*)

It was stated, in the description of the disease, that, if a favourable change did not take place from the ninth to the twelfth day, it was apt to alter its form, and assume many of the symptoms which characterize the advanced stages of the common enteric or typhoid fever. (See *page* 271.) In such cases, the tongue being dry, the skin dry, and the secretions generally deficient, it is advisable, if the patient has not already been salivated, to give the mercurial pill, in the dose of a grain every hour or two through the day, until the gums begin to exhibit some signs of its effect. Should diarrhœa exist at the same time, as often happens, about a sixth or quarter of a grain of opium, with the same quantity of ipecacuanha, may be given with each pill. Should any tendency to the paroxysmal form be observed, sulphate of quinia should be administered; and the same remedy is sometimes indicated, and very usefully employed as a tonic. For convenience sake, the mercurial pill with its adjuvants, and the sulphate of quinia, may be given together. After the mercurial influence has become evident, should no amendment be observed, oil of turpentine will often be found exceedingly efficient, in the dose of from ten to twenty drops every two hours. This acts as an alterative upon the inflamed, and probably ulcerated mucous membrane of the bowels. It may be given in emulsion with gum arabic, loaf sugar, and water, with the addition of a little laudanum, and of sulphate of quinia should that still be indicated. Nitrate of silver may be used as an alterative under the same circumstances. Should pressure upon the abdomen detect a tender spot, a few leeches may sometimes be employed advantageously; and in all cases, when there are diarrhœa and a tympanitic abdomen, this should be kept constantly covered with a large emollient cataplasm, to which a little mustard may be added, sufficient to sustain a slight feeling of warmth. Not unfrequently, the system sinks, in this form of the disease, into a very prostrate condition, requiring stimulants of a more or less powerful character to sustain life, until the course of the disease is run. Infusion of serpentaria is a mild stimulant, well adapted to the least debilitated of these cases. If stronger stimulation is required, in addition to the quinia and oil of turpentine already mentioned, carbonate of ammonia, wine whey, mulled wine, brandy, milk punch, &c., may be used, according to the degree of prostration, and the previous habits of the patient; and external stimulation by means of the hot bath, sinapisms, Cayenne pepper, oil of turpentine, or ammonia, should also be resorted to. Regular doses of opium, or one of its preparations, will often be useful by maintaining a gentle excitement, and quieting nervous disturbance. The practitioner should, under these circumstances, never despair; for recoveries sometimes take place from the lowest condition, short of the last agony.

Various incidental disorders require attention; and their treatment is often not less important than that of the main disease.

Gastric Disorder.—When there is frequent retching, with discharge occasionally of a mouthful of bile or other acrid liquor, indicating that there is offending matter in the stomach, effectual relief will often be afforded by copious draughts of warm water or chamomile tea, or even, in some instances, by a very mild emetic of ipecacuanha. Irritation existing in the coats of the stomach itself, and independently of its contents, should be treated by cataplasms made with powdered spices, or by sinapisms, or finally, if these fail, by a blister to the epigastrium, while an opiate is exhibited in small doses internally, or in a full dose by enema. It often happens that the end may be accomplished by the addition of the opiate to the medicine which may be given for other purposes, as to calomel, sulphate of quinia, &c. The effervescing draught often has a most happy effect in allaying vomiting. So also have small draughts of ice-cold carbonic acid water, which is moreover in general exceedingly grateful to the patient. In the somewhat advanced stages, limewater and milk, mixed in equal proportions, may be given in the dose of half a wineglassful, every half hour or hour, with very great advantage; not only allaying the gastric irritation, but yielding nutriment to the system in the most suitable form. Dr. Condie has repeatedly seen vomiting promptly relieved by a grain of acetate of lead every hour or two. (*Am. ed. of Watson's Practice.*) Should other means fail, a portion of the surface over the epigastrium may be denuded of the cuticle by means of a blister, and sprinkled with half a grain of powdered acetate of morphia. Sometimes irritants applied to the spine, or a few leeches or cups over some tender point of that column, will arrest the vomiting, when measures directed more immediately to the stomach have proved unavailing.

Should the stomach be inflamed, leeches or cups should be applied to the epigastrium. The greatest relief may often be afforded to the patient in this way. After bleeding, they sometimes act like a charm, not only in affording comfort to the patient, but in ameliorating the general character of the complaint. From four to six or eight ounces of blood may be abstracted. Afterwards, an emollient cataplasm should be applied, and kept for some time over the stomach, to be followed, if necessary, by a blister.

Encephalic Disorder.—In the early stages of the disease, when the head is hot and very painful, much ease may often be obtained by applying ice in bladders, or towels wet with ice-cold water, or placing the patient's head over a basin without the bed, and pouring over it a stream of cold water from a pitcher at a considerable height. While cold is thus applied to the head, revulsion may be effected towards the lower extremities by pediluvia of hot water, or mustard and water, especially when the feet and legs, as not unfrequently happens, are cool. *Cups* or *leeches* to the temples, or to the nape of the neck, are most valuable adjuvants in the treatment of the disease, affording sometimes the most entire relief, after bleeding has been employed ineffectually. When there is delirium or coma, besides the remedies just mentioned, the head may be shaved, and, if depletion has been carried sufficiently far without effect, the whole scalp should be covered with a blister. This is much more effectual than a blister to the back of the neck, which is often recommended. I have frequently applied the latter, but with no very decided impression; while the former has repeatedly appeared to be the means of preserving life. But it should not be postponed too long. The main cause of the disrepute into which blisters to the scalp have fallen, is probably the late period to which it has been customary to postpone their application.

It is unnecessary to refer particularly to the inflammation of other organs; as it is to be treated in the same manner as original inflammation of these parts.

Nervous Disorder.—Restlessness, wakefulness, general uneasiness, &c., may often be relieved by small doses of the nervous stimulants, as compound spirit of sulphuric ether (Hoffmann's anodyne), spirit of nitric ether (sweet spirit of nitre), camphor water, camphorated tincture of opium, infusion of valerian, &c. These may be given *pro re nata*, and may sometimes be advantageously connected with other medicines. Thus, camphor water may be used as a vehicle, so that a tablespoonful shall be given for a dose every hour or two. Gentle and steady friction with the hand to the arms, legs, and feet, has sometimes a most happy composing effect. Garlic poultices to the feet are also useful, especially in the cases of children. Sometimes great advantage is obtained from a pair of blisters to the arms or legs. Sleep may be procured in this way when opiates are contraindicated; as when the brain is over-excited, while the extremities are cool. Should opium not be contraindicated, it is on the whole the most effectual means for obviating morbid watchfulness. Sometimes, hyoscyamus, or lactucarium may produce the desired effect, when opium disagrees with the patient. Great advantage is often obtained from varying the preparations of opium, one answering a good purpose where another acts unkindly, and *vice versâ*. Thus, a salt of morphia will occasionally put to sleep when opium will not; and the changes may be rung upon solid opium, Dover's powder, extract of opium, laudanum, paregoric, black drop, the acetated tincture, and the different salts of morphia.

Hiccough, which is occasionally a very troublesome symptom, may be treated with camphor, assafetida, opium, valerian, chloroform, &c.; but the most effectual remedy, by far, in cases of necessity, is musk.

Convulsions in children require the warm bath, sinapisms to the extremities, garlic poultices to the feet, friction with garlic and brandy to the spine, &c. Opium is one of the most effectual preventives when they depend on any other cause than inflammation, or active congestion of the brain. Should they occur paroxysmally, sulphate of quinia should be employed.

Regimen.—No drink is so agreeable, and none on the whole more suitable, during the febrile exacerbations, than ice-cold water. It should be taken in small quantities, not exceeding two or three swallows at a time, and frequently. The patient also derives great comfort from small pieces of ice held in his mouth, and allowed slowly to dissolve. The drink may be varied by substituting, now and then, for pure water, orangeade or lemonade, apple-water, tamarind-water, or water flavoured with currant-jelly, blackberry-jelly, molasses, or freshly toasted bread. I have often found very acceptable to patients, in fever, a beverage consisting of weak molasses and water, with a little lemon-juice, and a piece of toast, and kept cool by ice.

The liquids above mentioned contain sufficient nutritive matter for the first day or two of the fever; but, as the complaint advances, something a little more nourishing may be given, as gum arabic dissolved in water in the proportion of an ounce to the pint, and flavoured, if deemed advisable, by sugar, lemon-juice, &c., barley-water, rice-water, or any other pure and weak farinaceous drink. The patient may also suck the juice of oranges, or swallow that of sweet grapes, discarding the skin, pulp, and seeds.

At a still more advanced period, especially in the remissions, and at all times in the remission if it be distinct, the patient may take a cup of black tea, with a piece of dry toast, morning and evening; or his strength may be supported by panada, by gruel of oatmeal, ground rice, or Indian-meal, to which a little milk may often be added, or by preparations of sago, tapioca, or arrow-root suitably flavoured. He may also be allowed a little well-roasted apple, or stewed fruit, care being taken that nothing hard or peculiarly difficult of digestion be admitted into the stomach. It is necessary that the physician should be provided with a diversity of articles of drink and food, in order to meet the incessant demands, the squeamish appetite, and the ever varying caprices of the sick. Happily, there is usually, during the fever, a disgust for food, which prevents the patient from taking it in injurious quantities, provided the injudicious interference of friends and nurses be guarded against.

Should the failing strength require further support, as often happens in protracted and in typhoid cases, a little milk may be allowed, or animal broths or jellies; and sometimes it becomes necessary to have recourse to the most stimulating food, as essence of beef or mutton (see *page* 224), milk-punch, egg and wine, &c.

In convalescence, it is very important to regulate the diet, both as to quality and quantity. Bread and butter, buttered toast, or milk-toast, boiled rice, mealy potatoes, weak broths, soft-boiled or poached eggs, oysters, boiled flesh of poultry, the broiled breast of birds or chickens, and finally the more easily digested meats in general, may be used in the order suggested, beginning with the lighter, and gradually rising to the more nutritious substances. When the appetite is somewhat languid, I have found that it is often sufficiently stimulated by a little crisp broiled lean of ham, or frizzled dried beef. When it is excessive, as often happens, the greatest caution should be observed against over-indulgence.

During the whole course of the disease, the patient's chamber should be well aired, and light and noise excluded. The covering should be just so much as is calculated to make the patient most comfortable. The bed and body linen should be frequently changed, all excrementitious matter quickly removed, and the air of the chamber sweetened and rendered refreshing by burning sugar after each fecal evacuation, or by sprinkling the apartment with lavender-water, aromatic vinegar, or something of the kind. No persons should enter the room except the attendants, and all conversation upon business, or exciting subjects, should be as much as possible avoided. When convalescence has commenced, all that can recall unpleasant associations should be removed from the apartment, light should be gradually admitted, the society of friends cautiously restored, and the patient allowed to resume, by degrees, his ordinary habits.

Convalescence.—This state, when imperfect, often requires continued medical supervision. The languid appetite must sometimes be encouraged, the general laxity of system counteracted, night sweats corrected, and various nervous disorders removed or quieted. The mineral acids often very happily meet the first three indications. Aromatic sulphuric acid (elixir of vitriol) is generally preferred; but the nitric, or nitro-muriatic may also be used; and the one last mentioned should be preferably employed, when the hepatic function requires moderate stimulation. Sulphate of quinia, or the simple bitters, and the chalybeates are often advantageous as tonics; the last, especially, when the system is left anemic. Sometimes a little porter, ale, or wine will be found useful.

Wakefulness and other nervous symptoms generally yield as the patient regains strength. In the mean time, it may be proper occasionally to administer one of the nervous stimulants. Opium or hyoscyamus, or their preparations, may sometimes be necessary to procure sleep, care being taken to withdraw them gradually, when no longer required. Hops, in the form of infusion or tincture, sometimes answer a good purpose under these circumstances.

Constipation should be overcome by a laxative diet, if possible; if not, by the mildest medicines, such as the confection of senna, magnesia when there is excess of acid in the stomach, rhubarb, a little castor oil, a Seidlitz powder, &c.

Active purging must be carefully avoided, as it endangers a relapse. Diarrhœa sometimes requires the use of gentle astringents. If the stools are clay-coloured, or in any other way indicate hepatic disorder, a mercurial pill, or a grain of calomel, may be given every night, or every other night, till the symptom disappears, the caution being observed not to give nitro-muriatic acid at the same time. For the treatment required by any organic disease of the liver or spleen that may be left behind, the reader is referred to the articles upon diseases of those organs respectively. The patient must be guarded against a too early exposure to fatigue. Some are anxious to regain strength by exercise beyond the powers of their system. They should be taught that nothing would be more likely than this to cause a return of the disease.

In relation to prophylactic measures in this complaint, the reader is referred to intermittent fever. I will merely add that many attacks of bilious fever might, in my opinion, be avoided by taking a mercurial cathartic, when the peculiar epigastric uneasiness which so often precedes the disease is experienced, and afterwards following the purgative with quinia in the quantity which would be necessary to prevent a paroxysm. I have no doubt that the same measure which is capable of interrupting the paroxysms, when formed, is also capable, if properly timed, of preventing the first paroxysm.

PERNICIOUS FEVER.

Syn.—Congestive Fever.—Pernicious Intermittent.—Pernicious Remittent.

I prefer the epithet *pernicious*, employed by the European continental writers to denote this form of miasmatic fever, to *malignant* or *congestive;* because, not having been generally applied to other diseases, it may be conventionally received as designative of a particular morbid state of great danger, to the exclusion of others which may be equally dangerous, but in a different way. The term malignant is either employed, in a general manner, to express extreme danger or fatality, or is appropriated to cases in which the blood has become greatly depraved, giving rise to certain peculiar phenomena, as in malignant typhus. If that epithet were applied to the affection in question, we could not refuse to embrace under it all extremely fatal varieties of bilious fever, or at least those which exhibit violent typhous symptoms. The term *congestive* is still more exceptionable; because, besides belonging to a vast number of other affections, of all possible degrees, and of wholly distinct characters, as, for example, to cases of arterial or active, as well as venous or passive congestion, it is, moreover, calculated to lead into erroneous views of the nature of the disease. It might be inferred, from the use of this epithet, that the congestion which certainly exists in this affection constitutes the essential part of it—the condition in which all the other symptoms have their origin, and from which danger is to be apprehended; whereas, as I shall attempt to show hereafter, it is a mere incidental phenomenon, and has little comparatively to do with the result.

It is not to all dangerous cases of intermittent or remittent fever that the epithet pernicious, as here employed, belongs. These affections may prove fatal, as before explained, by the supervention of various inflammations, by hemorrhagic effusion from ordinary causes within the cranium, chest, &c., by a typhous depravation of the blood, or by the gradual exhaustion of the vital powers through the excessive disturbance of the functions. None of these cases are necessarily included under the present heading. I propose to restrict the name to an affection, in which there is great and sudden prostration or depravation of the nervous power, or, to use a customary phrase, in which the *innervation* is extremely, and most dangerously, defective or deranged.

It may be asked, why make a distinct affection of what is nothing more than a modification of an ordinary disease? The answer simply is, that its extreme danger, and yet often easy curability when early recognized, render it desirable that the practitioner should have a vivid impression of its character and importance, which may be best given by treating of it distinctly; while the danger of false pathological views may be readily guarded against by due explanation.

This modification of miasmatic fever may be intermittent, remittent, or continued. But it is only when of two or three days' duration, that it can be said to be of the last mentioned form; for, if the patient survive this period, and the disease persist, it will almost certainly become paroxysmal. Most frequently, it is either intermittent, or exhibits a close approximation to that form; and happily, though often quotidian, its more common type is tertian.

SYMPTOMS, COURSE, &c.—The disease exhibits different phenomena, according to the direction of the morbid innervation. Thus, in some cases the organic functions are especially affected, in others the animal. In the former, the evidences of disease are presented chiefly in the organs of digestion, respiration, circulation, calorification, and secretion; in the latter, most prominently in the brain. There are differences also in the disease, as it is evinced most strikingly in one of the organic functions rather than in another, though most of them are simultaneously affected. Thus, the force of the morbific cause appears to fall, in some instances, directly and especially upon the heart, in others upon the alimentary canal, in others again upon the surface of the body, either in its function of secretion or calorification.

The attack may occur at any time in the day, or in the night. Sometimes it comes on at once, with its own peculiar characters. More commonly, however, the first symptoms are those of ordinary miasmatic fever, or at most equivocal. Thus, the patient may have been seized with a paroxysm, differing apparently in nothing from that of a regular intermittent; and it is only in the second, or perhaps even in the third paroxysm, that the pernicious phenomena are exhibited. Or, the first symptoms may be chilliness, severe pains in the back, limbs, and head, frequency and irregularity of pulse, flashes of heat alternating with slight perspirations, &c., as if a remittent were endeavouring to form itself; when gradually or suddenly, as the case may be, an alarming change becomes obvious, and the patient is seen to be in the midst of the greatest danger. Again, a remittent may have existed for several days, without showing any peculiar symptoms; and then, with or without warning, may assume the pernicious character.

Disease in the Organic Functions.—When the disease is fully formed, and exists primarily in the organic functions, the following symptoms are presented, though not all of them necessarily in every case. There is something strikingly peculiar in the appearance of the patient. The face, hands, and feet are of a livid paleness; the features shrunk and impassive, or singularly expressive of an amazement or alarm which the patient does not feel; the eyes often sunk in their sockets, though still clear and even bright; the skin contracted, and the fingers shrivelled as if long soaked, like those of a washerwoman, in soap and water; the extremities and sometimes even the trunk chillingly cold, though not sensibly so to the patient; the surface either partially moistened with a clammy perspiration, standing sometimes in large isolated drops like bullæ upon the face and breast, or universally bathed in a profuse cold sweat. In some cases, the surface of the chest and abdomen is morbidly hot, while the extremities are cold.

The tongue is sometimes pale and cold, sometimes dry, and sometimes again little altered from its previous state. There is almost always a feeling of epigastric weight or oppression, with tenderness upon strong pressure; and often of intense internal heat, with excessive and unquenchable thirst. This sense of burning heat and thirst is among the most striking symptoms, when taken in connexion with the positive reduction of temperature over the greater portion of the surface, and sometimes even within, as indicated by the tongue and breath. The patient calls incessantly for cold drinks, and can never be satisfied. "Oh that I could lie in the river!" "Oh that I could have a stream of cold water to flow through me!" are his frequent exclamations. (Parry, *Am. Journ. of Med. Sci.*, N. S., vi. 29.) But whatever he drinks is usually rejected almost as soon as swallowed. Incessant vomiting is one of the most frequent symptoms. Sometimes bile may be discharged; but generally the matter thrown up is either what may have been swallowed, or a muco-serous fluid, occasionally tinged with blood. In many cases, there is only extreme retching, with little discharge. The bowels are sometimes confined, but oftener the reverse; the dejections being exceedingly copious and frequent, in many instances not less than several times an hour. The discharges sometimes consist of a bloody serum, like the washings of flesh, sometimes of blood nearly or quite pure, and either dark-coloured and uncoagulable, or partially in clots. Several ounces of blood are not unfrequently lost with each evacuation. Torti, an Italian writer upon this disease, considers among the cases of pernicious intermittents those attended with copious bilious vomiting and purging, or dysenteric discharges with severe abdominal pains. But as these are incomparably less fatal than the others, and depend rather upon vascular irritation or inflammation of the organs affected than upon morbid innervation, they do not come within the definition of the disease as here given. Indeed, the occurrence of bilious discharges may, in cases of pernicious miasmatic fever, as in those of epidemic cholera, be looked upon as a favourable sign. In some cases, the abdomen is tympanitic; but this is not a common symptom.

The state of the respiration is often highly characteristic. The breathing seems like a succession of deep sighs, and occasionally each inspiration is interrupted in its progress, and effected as if by a double effort. This last is considered by Dr. Parry as a fatal symptom. (*Ibid.*, p. 29.) Occasionally, however, the respiration is hurried, irregular, and panting. The patient frequently complains that he cannot get his breath, and desires to be fanned, or longs for the external air.

The pulse is small, irregular, sometimes corded, but often feeble, and even fluttering. Occasionally it is intermittent. It is almost always very frequent, amounting to 120, and sometimes to 160 in the minute. Not unfrequently, it is quite absent at the wrist, though distinctly perceptible in the carotids. According to Dr. Boling, the action of the "heart is loud, strong, and tumultuous." (*Am. Journ. of Med. Sci.*, xi. 309.) This, of course, must have been so, in the cases observed by that writer. It is possible that the heart may have its natural share, and even more than its share of nervous energy, whilst the innervation of the extreme arteries and capillaries may be defective. But the remark does not correspond with my own observation. Generally, the heart, though for reasons explained elsewhere (see *Pulse*, page 184) contracting very frequently, has appeared to me to be feeble, rather than energetic in its action.

Along with the symptoms above enumerated, there are often great restlessness, general uneasiness, and jactitation. The patient, not aware of his extreme danger, and sometimes wondering at the anxiety exhibited by his attendants, often attempts to rise from his bed, and, if not prevented, will walk to the window or door of the apartment. The direct cerebral functions, including the action of the will upon the muscles, are singularly undisturbed, in the midst of the wreck of the organic life. The patient will sometimes walk about his room, hours after the pulse has ceased to be felt at his wrist. Occasionally, as in cholera, there is painful spasm of the muscles of the extremities, especially of the calves of the legs. Indeed, the analogy between many of the symptoms above described, and those of epidemic cholera is very striking.

As already mentioned, the course of the symptoms is various. Sometimes they continue as above described, with greater or less intensity, mingled, perhaps, with unsuccessful attempts at reaction, for a period varying from one to three days; when, unless relieved by remedial measures, they terminate in death. The coldness increases, invading sometimes the whole body, except a small portion near the heart; the respiration becomes slower and more sighing, with lengthening intervals between the acts; the pulse gradually sinks, and often quite ceases in the extremities for several hours before death; the cerebral functions at last fail; the countenance assumes the hippocratic expression; and the patient usually dies tranquilly, as if falling into sleep.

But much more frequently, after continuing for three or four hours, evidences begin to show themselves of a disposition to reaction. The skin becomes gradually warmer, the pulse fuller and stronger; and something like a febrile exacerbation usually takes place, though in no degree proportionate to the preceding prostration. Not unfrequently, repeated partial efforts of this kind are made, before reaction is accomplished; and sometimes the symptoms abate without the occurrence of a real access of fever. The warmth may be perceived gradually, but often very slowly, diffusing itself from the central parts of the body towards the extremities, the surface at the same time losing its disagreeably clammy feel; the death-like hue and ghastly expression of the countenance disappear; the vomiting and purging, if before existing, diminish greatly if they do not cease; the pulse resumes its ordinary fulness and strength, and at the same time becomes less frequent; and the patient seems as if about to be restored to health.

Sometimes a degree of frequency of pulse remains, with uneasiness of stomach, some general languor or distress, and more or less of the other phenomena of the paroxysm. It is only a remission that has taken place. In other cases, the patient appears almost free from disease, with a natural pulse, a natural surface, some return even of appetite, and only a certain feeling of languor, and perhaps of epigastric uneasiness remaining. This is an intermission. So far as concerns the treatment, the distinction is of little consequence; for the same measures are necessary in either case. Perhaps the chance of a favourable issue may be greater, in proportion to the completeness of the intermission.

If the disease be not arrested by artificial means, the same train of symptoms sets in at the corresponding hour of the following day, or the day after that, and usually with increased violence. This paroxysm often proves fatal; but often also the apparently overwhelming flood of disease ebbs once more, and affords to the patient another chance of safety. If this is lost, the third paroxysm is, in the great majority of cases, inevitably fatal. The symptoms preceding death are those already described, as sometimes occurring without any remission, within one, two, or three days of the first attack. It is not, however, every case of pernicious miasmatic fever that ends unfavourably, even without treatment. Sometimes nature proves strong enough to resist the force of the disease; each succeeding paroxysm becomes milder and milder; and at length nothing but an ordinary intermittent is left. In other instances, the disease runs on with remissions, and either subsides into an ordinary bilious fever, terminating in the ordinary way, or assumes a malignant typhoid character of various duration and issue. It is usually deemed a favourable incident, when copious alvine evacuations of a dark tar-like liquid take place from the bowels; as they indicate a restoration of the suspended action of the liver.

It may be proper to notice some of the more prominent diversities in the variety of the disease above described; that, namely, in which the organic functions are chiefly concerned. Sometimes the force of the disease appears to be directed especially to the heart, and the prominent phenomena are those of excessive prostration of the circulation. The patient is extremely weak, and becomes faint upon the least exertion, with excessive feebleness of pulse, cold sweats, &c.; but without nausea, vomiting, purging, or abdominal distress of any kind. In this, as in the other forms, there may be one or two remissions or intermissions; but, unless saved by remedies, the patient dies at last of pure syncope.

In other cases, the coldness is the most prominent symptom, gradually deepening as the paroxysm advances, and at length occupying almost the whole surface, without any primary extraordinary reduction of the pulse, and without disorder in the digestive functions. The heart at length gives way, and the patient perishes in the first or the second paroxysm.

Again, instances frequently occur, in which more or less febrile action alternates or mingles with the signs of depression. Severe pains in the head, back, and limbs, flushes of heat followed by partial perspirations, a certain degree of fulness and strength of pulse, and hurried and oppressed breathing, mark these vain efforts of the system. They are the mere flashes of the expiring taper; and finally give way before the force of the depressing causes.

Sometimes, the paroxysm of an intermittent runs its usual course; but the perspiration with which it ends becomes exhaustingly profuse, and the pernicious symptoms appear.

Disease in the Animal Functions.—An equal diversity does not exist, in the cases of defective or deranged cerebral action, as in those in which the organic functions are primarily affected. In the former, the paroxysms are attended with a greater or less degree of stupor. Usually, they begin with simple drowsiness, the patient forgets quickly what he may have done, said, or desired; stops, when speaking, in the middle of a sentence, or uses one word for another; and often stammers. This dulness gradually increases into deep coma, from which the patient cannot be roused. The respiration is somewhat noisy, and stertorous as in apoplexy. The pulse is full, and, though generally somewhat accelerated, it is much less so than in other cases, and occasionally is even slower than in health. It often, too, has considerable strength. Sometimes there is a tetanic closure of the jaws; and, when they are forced open, and liquid introduced into the mouth, there is found to be great difficulty, if not impossibility of deglutition. Maillot, who treats of the disease as it occurred at Algiers, speaks of epileptic convulsions, with grinding of the teeth, and foaming at the lips, as having been sometimes observed. In some cases, the comatose symptoms occur in the first paroxysm; but more frequently they are not completely established until the second; the first having differed from an ordinary paroxysm only in being attended with drowsiness, and a degree of slowness or hesitation in speech. If the comatose paroxysm do not end fatally, after a variable duration, some perspiration takes place, sensation gradually returns, and the patient may have no symptom of the disease remaining; though, more frequently, he continues somewhat soporose in the interval. The next paroxysm usually proves fatal, like an apoplectic attack, unless arrested. In some cases, the comatose symptoms are preceded by delirium.

Dr. Boling, of Montgomery, Alabama, has noticed cases of remittent fever in which the morbid innervation took the character of tetanic spasms. After a few febrile exacerbations, the approach of the paroxysm was marked by the occurrence of spasmodic phenomena, exactly resembling those of an attack of tetanus, which afterwards continued, increasing and diminishing in general with the exacerbations and remissions of the fever, until the close. In some instances, there was complete stupor or coma throughout the remainder of the disease; in others, only during the paroxysms; and in most, some degree of intelligence remained. In no case did the disease extend beyond the fifth day after the supervention of spasm; and generally, if not arrested, it ended fatally at an earlier period. The result was generally unfavourable. (*N. Orleans Med. and Surg. Journ.*, iii. 733.)

Diagnosis.—It is of the utmost importance to be able to distinguish this from the ordinary forms of miasmatic fever; because the safety of the patient depends upon the adoption of prompt and vigorous measures, which are not deemed necessary in other cases. When fully formed, the affection can scarcely be mistaken, if the practitioner be upon his guard. Its possible occurrence in any instance of bilious fever, should be borne in mind. I have no doubt whatever that death frequently arises from a want of this caution. Cases of the kind have indeed fallen under my own observation. In the course of a bilious remittent, symptoms of a pernicious character appear, and yield perhaps after a time, either to the remedies employed, or in the regular course of the disease. The amendment is very naturally supposed to be the commencement of convalescence, and no extraordinary measures of safety are resorted to. But the apparent retreat of the disease is only the preparation for a more vigorous onset, and, when the onset comes, in an unguarded state of the defences, it is irresistible.

Not unfrequently, in the intermittent form of the disease, the first paroxysm offers nothing to alarm the physician; and, not apprehending anything serious in the second, he neglects a most important opportunity for the use of remedies. It is, therefore, highly desirable to know whether there are any symptoms in the preliminary paroxysm which prognosticate danger. Often there are such symptoms, which the physician should always be prepared to appreciate. An unusual paleness or lividness of the face; an absence of rigors or sense of chilliness, or a feeling of heat, while the extremities are really cold, and a want of uniform heat after reaction; a disposition to copious or frequent vomiting and purging, with a sense of unusual weight or oppression at the epigastrium; an extraordinary frequency, feebleness, or irregularity of the pulse; much anxiety, restlessness, or tossing about of the limbs, or a disposition to faintness; considerable delirium or drowsiness; a prolongation of the cold stage, and a less degree of febrile excitement than might have been anticipated; and the continuance in the apyrexia of some mental confusion, sleepiness, faintness, or unusual anxiety and uneasiness; any of the above symptoms should be a sufficient warning to the practitioner, not to delay for a moment the measures requisite for interrupting the paroxysms.

ANATOMICAL CHARACTERS.—M. Maillot found in the cases which he examined, amounting to thirteen in number, injection and opacity or opalescence of the arachnoid, injection of the pia mater, increased density and injection of the brain, deepened colour of the cortical substance, and limpid or bloody effusion in the ventricles. Similar marks of congestion in the spinal marrow were observed. The mucous membrane of the stomach was very often so much softened, that it might be scraped off in the form of pulp, sometimes thickened, in some instances bright red or blackish, and in others perfectly white. The duodenum, and portions of the jejunum and ileum, were similarly affected. Sometimes a great number of the isolated follicles were enlarged, without surrounding redness, sometimes punctuated patches of redness were observed. The colour was in some instances healthy, in others presented a blackish hue, with softness, and enlarged follicles. The liver was variously affected, being either red and soft like the tissue of the spleen, or enlarged, yellowish, dry, and brittle; or of enormous size and engorged with blood; or softened to the consistence of paste; or, finally, quite healthy. Of these alterations some were no doubt pre-existent. The spleen was always enlarged, generally much congested with blood, and either firm, or softened so as to resemble the lees of red wine, or of a pasty consistence and chocolate colour, and in one instance ruptured. The contents of the chest were generally healthy.

CAUSE.—The essential cause of this affection is undoubtedly the same as that of the ordinary forms of miasmatic fever. What it is that gives rise to its peculiar characters is unknown. We may say, in general terms, that it is probably a more intense action of the miasmatic poison, or an unusual susceptibility to its influence. Dr. Parry tells us that in Indiana, while ordinary bilious fever occupies the table lands, the pernicious form has been observed to prevail especially in the low grounds skirting the rivers. According to Dr. Lavender, of Selma, Alabama, intermittents and remittents are common in certain seasons when there is little or no pernicious fever. (*Am. Journ. of Med. Sci.*, N. S., xvi. 44.) The latter is rare in the miasmatic districts of the middle and eastern section of the Union. I have seldom seen the complaint in Philadelphia or the neighbourhood, except in the hospital among sailors recently from the southern coast, or among medical students from the Southern and Southwestern States. Latitude, moreover, appears to have some influence upon the character of the disease; for, while in the countries north of the Ohio it generally assumes the intermittent form, in the State of Mississippi, according to Dr. Wharton, this disposition is much less obvious. The weakness of old age, or previous disease, does not appear to constitute a predisposition; for, according to Dr. Parry, the greater number of fatal cases is between 25 and 35, and among the plethoric and robust (*Am. J. of Med. Sci.*, N. S., vi. 28); and, according to Dr. Wharton, persons between 20 and 30 are most subject to the disease (*Ibid.*, vii. 339). The former of these observers never saw a case in an individual under 20; the latter states that the disease is comparatively rare under 10. A singular fact mentioned by Dr. Parry is, that, while new-comers in the miasmatic districts are much more subject to common bilious fever than the old residents, the latter are equally liable to the affection under consideration. M. Bricheteau, physician to the Hospital Necker, has published several cases, which would seem to prove that intermittents, occurring in old persons, and especially those debilitated by chronic disease, are apt to take on the pernicious character, and to prove exceedingly fatal. (*Archives Gén.*, 4e sér., xiv. 184.)

NATURE.—What is it that imparts its peculiar character to the pernicious fever? Can it be inflammation? Is it possible that this process can be extinguished and relighted, extinguished and relighted again, so suddenly? It has been suggested that, the general excitability being exhausted by the violence of the paroxysm, the inflammation may continue to exist in the interval, and yet be unable to bring the system under its influence. But who can conceive of an acute and fatal inflammation of the mucous membrane of the stomach, with considerable appetite, or of the brain, with a perfectly sound intellect, and without headache or other cephalic uneasiness? Inflammation, in a certain degree, may co-exist with the other phenomena; but it constitutes, in most cases, no portion of the danger; for all the difference between death, and a speedy restoration to health, lies in a few grains of quinia. Who has ever administered quinia, in ordinary cases of acute gastritis, or acute meningitis, with similar results?

Is congestion the source of danger? I cannot think so. It is confessedly venous congestion that is present in these cases. We constantly meet with this condition in other complaints with no such results. We see it in syncope, when all the blood deserts the capillaries, and becomes concentrated in the veins and great organs. We see it in concussion of the brain, occasionally in no less degree than in pernicious fever. We behold it in all cases of violent shock upon the nervous system, prostrating the power of that system, and consequently of the heart, as in severe surgical operations and violent injuries. Yet, in all these cases, it is not the congestion, but the nervous prostration that we fear. Let the latter be relieved, and the former ceases of course.* Congestion may occasionally do fatal mischief; as in cases of rupture of the spleen; but these are comparatively rare.

It is in the peculiar state of the innervation that we are to look for the source at once of the symptoms and the danger. This does not consist in a universal prostration of the nervous power. On the contrary, while defective in relation to certain functions, it may be unimpaired in others. Let us apply this view to an explanation of the symptoms. In the first place, in relation to the cases of collapse, in which the organic functions are especially concerned. This is prominently characterized by a want of action in the capillaries and extreme arteries. Some suppose that these vessels are spasmodically contracted. There is no evidence whatever of the existence of such spasm. They collapse simply because they contain no blood, just as they collapse in death. All parts of the organism receive a certain supply of nervous influence, which is essential to the due performance of their functions. The extreme vessels are probably not less under that influence than other parts. Evidence of this fact is abundantly supplied by physiology. In the pernicious fever, the innervation of the extreme vessels fails, and they cannot, therefore, perform their part effectively in the circulation. The blood enters them with difficulty, in their enfeebled state, and is carried through them very slowly. Hence the paleness; and hence also the lividness of the surface, owing to the stagnation of the blood. From the same approach to nervous death in these vessels, they allow the watery portions of the blood to ooze through them, almost as through dead membrane. Hence the profuse sweats. The coldness obviously arises from the languid circulation, and deficient change of blood. This condition of the capillaries may coexist with considerable power in the heart; for the want of innervation is not necessarily equal in the whole circulation. Nay, the heart may be excited to tumultuous action by the calls upon it of the empty capillaries through the nervous centres. But sometimes the deficiency is experienced first and specially by the heart. In such cases, syncope or a tendency to it is the prominent symptom.

The function of respiration sometimes suffers from the same deficiency of innervation. The pulmonary capillaries cease to carry forward the blood with the usual rapidity, and the due aëration does not take place. Hence the feeling of oppression of chest and want of breath, the deep sighing, &c. Some writers ascribe these phenomena to congestion of the lungs. They are the consequence of a want of proper decarbonization or oxidation of the blood, not of mere congestion. In the cases of Maillot, the lungs were found remarkably free from disease after death.

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* For an interesting paper on this subject by Dr. Isaac Parrish, of Philadelphia, the reader is referred to the *American Journal of the Medical Sciences*, N. S., ix. 293.

But how account for the oppression of stomach, and the copious vomiting and purging? Upon the same principles exactly. There is no feeling of the stomach, unless it may be excessive spasm, which is more insupportable than that arising from deficient innervation. This can be readily understood by those who have experienced the distressing sensations of a half paralyzed limb. The bloody serum, or pure blood, discharged from the stomach and bowels, escapes through the coats of the vessels, exactly as blood percolates through the tissues after death; with this exception, that, as the vis a tergo still continues in some degree, it adds a vital expelling force to that of mere physical transudation. The alimentary canal may be said to sweat, like the external surface. An appeal may be made to the discoloration, softening, &c., of the mucous membrane, as evidence of inflammation or congestion. I am not disposed to deny the occasional existence of some degree of inflammation, in this membrane. But it is quite insufficient to account for the symptoms. We do not witness the same phenomena in other cases of much more extensive inflammation. Besides, much of the softening of the tissue may be ascribed to depressed vitality, and much of the discoloration to the stagnation of blood, like the livid or purple colour of the skin.

But the thirst and sense of internal heat; are they not signs of congestion or inflammation? By no means. Thirst is a common accompaniment of all conditions of disease in which the capillaries are emptied of their blood, and such is undoubtedly the source of it here. (See *Thirst*, page 178.) The heat can be referred only to morbid nervous influence. That there is no real increase of temperature within, is inferred from the coolness of the tongue. Besides, the sensation is not confined to the internal parts. I have known patients to complain, under these circumstances, of distressing heat of surface, when their skin was positively much below the healthy temperature. This is merely another example of morbid innervation. It appears, then, that this defect or derangement of innervation lies at the basis of all the morbid phenomena of the organic functions. The congestion necessarily follows the prostration of the active circulating forces. The pulmonary capillaries, the heart, and the systemic capillaries are all enfeebled; the blood, therefore, collects in the veins and in the great internal organs, especially in those connected with the portal circulation. Hence the congestion of the liver and spleen. When the circulatory movements return with their wonted activity, under the restored innervation, the congestion is speedily dissipated.

In the cerebral cases, the deranged innervation is experienced primarily and chiefly in the lobes of the brain. The organic functions are at first comparatively unaffected, the heart often continuing to act with energy, and the surface to retain its warmth, when the patient is quite insensible. That the affection is chiefly nervous, is to be inferred from its periodicity. There may often be congestion; there may sometimes be inflammation of the brain. But the presence of an excess of blood is probably due less to increased determination than to stagnation in the capillaries. The colour of the cortical portion is described by M. Maillot as approaching to black. The brain differs from other organs in the circumstance of occupying a closed cavity, into which atmospheric pressure alone would force the blood, so that feebleness of the capillaries cannot here be followed by paleness as upon the surface. The vessels must always be full, or the vacuity must be compensated by effusion. Redness, therefore, and serum in the ventricles are not necessarily signs of over-excitement. But I am not disposed to maintain that the cerebral affection, in these cases, is certainly the result of diminished sensorial action. It may be so; or it may proceed from some other derangement of that action. All that I would maintain is, that the affection is essentially nervous; and that upon this the danger depends. The patient dies, not because he has too much blood in his brain, but because the brain becomes incapable, from the direct influence of the morbid cause, of performing the functions essential to life. This question is not merely speculative. It is, on the contrary, highly practical; and its decision, one way or the other, may greatly influence the treatment. If the disease be considered in the light of apoplexy or cerebritis, copious bleeding would suggest itself as the appropriate remedy; if it be nervous, we must look for safety to some means capable of strongly impressing the nervous system.

PROGNOSIS.—This is exceedingly unfavourable in all cases, either not treated at all or treated inefficiently. According to Dr. Parry, three-fourths of the cases without treatment, or with the usual treatment for bilious fevers, end fatally. Under proper management the result varies greatly with the opportunities of the physician. If the disease be intermittent, and seen so that remedies can be applied during the whole intermission, the life of the patient may almost always be saved. If seen during the first or second paroxysms, the dangers of these may often be averted, and many recover. Few comparatively can be saved from the third pernicious paroxysm. In the remittent or continued form, the danger, one would suppose, must be greater; yet, out of 186 cases of all kinds, Maillot had 38 deaths, or 1 in about 5; while 99 remittent or continued cases, gave only 19 deaths, or very nearly the same proportion. (*Trait. des fièvres*, &c., p. 277.) This was under the quinia treatment. Bailly gives the result of 886 cases in the hospitals at Rome, in 1818 and 1819, at 545 cures and 341 deaths, or one out of 2.6. (*Trait. Anatomico-pathol. des fièvres intermit. Append.*, p. 10.) Dr. Parry gives the general result of special treatment at 1 death in 8 cases. (*Am. J. of Med. Sci.*, N. S., vi. 28.) Dr. Wharton states that the disease does not prove fatal in more than 1 case out of 12 or 15, "under proper treatment timely administered." (*Ibid.*, vii. 339.) Of course, the general average of deaths must be greater than this; for all cases cannot be seen in time.

TREATMENT.—If the patient is seen first in the paroxysm, the urgent indication is as soon as possible to bring about reaction. Not long since, under the notion that congestion was the evil to be encountered, copious bleeding, and large doses of calomel, were the remedies most relied on by many practitioners. Experience, however, has proved the frequent inefficiency and even danger of this practice; and the profession have, I believe, generally abandoned it. In some of the cerebral cases, with a full and tolerably strong pulse, it is proper to abstract blood from the arm, and also to take it locally from the temples; but in all others, the remedy is much worse than useless. While the whole organic actions of the system are prostrate under the vast nervous depression, and life is running out with the serous discharges from the skin, and the sero-sanguineous discharges from the alimentary canal, to open another outlet in the arm seems as contrary to sound pathological principles, as it is opposed by multiplied experience. Exactly the opposite course should be pursued. Efforts should be made to rouse the nervous system from its lethargy, and to restore the organic actions; while further exhaustion is prevented by checking the profuse exhalation from the inner and outer surfaces of the body.

One of the most obvious remedies is artificial heat. Heated bricks, bottles filled with hot water, heated flat-irons, &c., may be placed along the limbs, without being in contact with them; the feet may be placed in hot water or mustard-water; or the whole body may be immersed, if convenient, in a hot bath of 105° Fahr. Sinapisms may be applied to the extremities, and over the whole abdomen, or along the spine; or frictions may be made with heated Cayenne pepper and brandy, or hot oil of turpentine. Some recommend very strongly, as the most efficacious external remedy, especially when the perspiration is profuse, dry friction over the whole body with Cayenne pepper or mustard; and I have no doubt of its usefulness. Besides the measures mentioned, a strong ammoniacal liniment may be applied along the spine, so as to excite redness over its whole length. Dr. Lewis, of Alabama, strongly recommends dry cupping over the spine. (*N. Orleans Med. and Surg. Journ.*, iv. 172.) To sustain a more steady excitement, blisters may be applied to the insides of the legs and arms.

Nor should internal remedies be neglected. Opium is strongly indicated for its stimulant and anti-emetic properties, and for its influence in arresting alvine discharges. It is, upon the whole, most advantageously used in substance. When the stomach is retentive, laudanum may be preferable from its somewhat quicker action; but it is more apt to be rejected than opium. When the latter offends the stomach, one of the salts of morphia may be substituted in an equivalent dose. The only circumstance which would strongly contraindicate the use of opium is the existence of obvious disease of the brain, as shown by active delirium or stupor. Acetate of lead is an astringent peculiarly adapted to the case, and may be given, with great propriety, when the evacuations are copious, and especially when they are hemorrhagic. Kino, if borne by the stomach, may be added. As stimulants, the best are probably oil of turpentine and Cayenne pepper. But should these fail, recourse may be had, especially in the cases of syncope, to ammonia, wine, brandy, or ether. It is better, however, if possible, to get the patient through without alcoholic stimulus, which may possibly prove injurious in the subsequent reaction. Camphor is a favourite remedy with many practitioners; but I have little faith in it in these cases; and, in the existing irritability of stomach, it is best not too much to complicate prescriptions. Sulphate of quinia may be advantageously employed, even in the paroxysm, before reaction. It is indicated for its excitant influence upon the nervous centres, and is all important in reference to the next paroxysm. It may be given in any prostrate case, in which it can be borne by the stomach. Another remedy, which is decidedly called for, is calomel. The complete inactivity of the liver which exists in most cases demands interference, and, when the case approaches the continued form, it is of great importance to establish the mercurial influence. The proper combination of these remedies, and the regulation of their dose and time of administration, are scarcely less important than the remedies themselves. As a general rule, when the head is not affected, and the discharges are copious, opium should be added to all the other medicines.

In the worst cases, medicine should be given as often as every half hour until some excitement is evinced. Two grains of sulphate of quinia, two grains of calomel, and half a grain of opium, may be made into one or two pills, according to the patient's ability to swallow, which, along with one or two other pills containing five grains of Cayenne pepper, may be given every hour; while, at the intervening half hour, the patient, in cases attended with profuse alvine discharges, may take two grains of acetate of lead, five grains of kino, and half a grain of opium, made into two or three pills. When time is of the utmost consequence, the above dose may be increased; when there is more time to spare, the interval may be lengthened. Of course the proportions must vary to suit circumstances. So also must the articles employed. If the Cayenne pepper should not agree with the stomach, or appear insufficiently excitant, twenty or thirty minims of the oil of turpentine may be substituted; and even considerably larger doses are sometimes well borne; but the tendency of this medicine in large doses to purge must be remembered. Should the kino offend the stomach, it may be omitted. Of course, neither this nor the acetate of lead is to be employed, when there is no considerable diarrhœa, or hemorrhage from the bowels. The calomel may be suspended when the patient has taken from ten to twenty grains, and at any time, if the least soreness of the gums should be perceived.

It is sometimes long before reaction appears, but the practitioner should not be discouraged while life remains. The remedies above mentioned should be persevered in, with the addition, if necessary, of wine or brandy, until heat begins to be restored to the surface, and the pulse to acquire increased fulness. They may then be gradually relaxed; and, after reaction has been fairly established, should be cautiously omitted. At this point the patient may be considered comparatively safe.

It would be wrong not to mention that other means of producing reaction have been highly recommended. Some practitioners in the west and southwest habitually employ cold affusion, or the cold bath. Dr. Gustine, of Natchez, informed the author that he had once immersed a patient, while in the lowest stage of a pernicious paroxysm, with a cold skin, and nearly or quite pulseless, but complaining bitterly of the burning heat which was consuming him, in a bath of cold water, with the happiest effect. The remedy was agreeable to the patient; and he was allowed to remain until he began to feel somewhat chilly, when he was removed, wiped dry, and placed in bed. Reaction came on delightfully, and his life was saved. Dr. Richmond, an old and experienced practitioner of Indianapolis, is in the habit of causing his patient to lie naked at full length, and of pouring cold water from a pitcher upon him from head to foot, until he begins to shiver, when he is wrapped in a blanket, and plied with stimulants diligently, internally and externally. I was assured that this measure had proved effectual in several apparently desperate cases. Dr. Barbour, of St. Louis, Missouri, esteems the affusion of cold water, above all other means in the treatment of this disease. (*Observ. on Int., Remit., and Congest. Fever, St. Louis*, 1847, p. 26.) The remedy is certainly one not to be hastily rejected. Nature seems to point it out by the burning heat of which the patient complains, and the great comfort he derives from the remedy. Nor is it irrational. The nervous system is chiefly in fault in these cases. A strong impression is made on that system by the sudden application of cold to the skin. If there be any power of reaction left, it is apt to be awakened by this shock. But care must be taken not to carry the remedy beyond the production of a chilly sensation, or slight shivering. This is the condition of an ordinary chill, and it is wanting in the cold stage of pernicious fever. Perhaps the best mode of reducing the latter to the former may be the employment of a measure calculated to produce the sensation of chilliness.

Another remedy employed by some practitioners in the west and south, in the pernicious paroxysm, is an emetic. I can readily understand that it may sometimes rouse the system, and bring about reaction, when the stomach is not already irritable. The remedy has long been employed in the protracted chill of ordinary intermittents, as one mode of exciting reaction, though now generally superseded by less disagreeable remedies. Dr. Geo. G. Banks, of Clinton, Mississippi, uses for this purpose powdered mustard, of which he gives a tablespoonful in a pint of warm water, and repeats the dose in a short time if the first does not operate; and I have been informed that the practice is very successful. He follows the emetic with morphia.

When the paroxysm of pernicious fever is marked by coma, blood, as before observed, may be taken from the arm and temples, when the pulse is strong. In doubtful cases, it may be better to rely upon cups alone. Towels wet with ice-cold water should be placed around the head, or a bladder filled with pounded ice applied to it; while action is invited to the lower extremities by hot foot-baths, sinapisms, &c. If the patient can swallow, a dose of calomel should be given, followed by some other cathartic or an enema; but the chief reliance must be placed upon the treatment in the remission or intermission.

After reaction has been produced, if the case do not eventuate in a decided remittent or intermittent, it is to be treated as ordinary bilious fever; care being taken to watch it vigilantly, and guard against any tendency to relapse into the prostrate state, which is not uncommon. If the bowels have been previously confined, the calomel which was given in the cold stage, should now be carried off by a dose of castor oil, or of a mixture of that medicine with oil of turpentine, which, under these circumstances, is strongly recommended by Dr. Wharton. Its operation may sometimes be much facilitated, according to the same authority, by a hot bath. Dr. Wharton does not consider his patient safe, in this state of the disease, until he has obtained copious black tarry evacuations from the bowels.

As soon as a remission or intermission has been obtained, there is but one course of treatment, and that is all important. There should be no delay for previous treatment; no waiting for a more perfect relief from this, that, or the other symptom. Such dallying has been but too often fatal. No matter whether the patient has been under treatment during the paroxysm or not, no matter how partial the remission, provided it be a remission; no matter at what period of the interval the practitioner may have been called, his first, his last, almost his only thought, should be sulphate of quinia. This is the remedy for the disease, and only this. At least none other approaches to it in efficacy; sulphate of quinia being considered merely as the representative of the virtues of Peruvian bark. From thirty to sixty grains of this salt should be given, from the commencement of one paroxysm to that of the next. If none has been given or retained, during the paroxysm, the whole should be administered in the remission or intermission. The dose must be regulated by circumstances. When the disease is quotidian, with a short apyrexia, the doses must be large; when tertian, they may be smaller. They should be administered so that the whole quantity may be got down two or three hours before the time for the recurrence of the paroxysm. From two grains up to half the amount necessary for the whole interval may be given at once. Nothing should deter from the administration of this remedy. Even excessive irritability of stomach is no sufficient contraindication. If the quinia be rejected alone, it should be combined with opium or morphia; if still rejected, it should nevertheless be administered in the hope that a portion at least may be retained; and recourse should be had to enemata, and to the endermic application. If administered by injection, it should be mixed with laudanum or morphia, and with a little acid so as to dissolve the sulphate, and should be given in double or triple the quantity that might be necessary by the mouth. If applied externally, a large blistered surface should be made over the epigastrium, and the salt applied very much diluted, in order to prevent inflammation, and consequent interference with absorption. It has even been proposed to inject it into the veins; but it is only in otherwise desperate cases that this method of administration would be justifiable, in the present state of our knowledge; and, should it be resorted to, care must be taken that the salt be thoroughly dissolved.

The paroxysm is almost always prevented, or, if not, is rendered much lighter than it would otherwise have been. But the sulphate of quinia should be continued, in quotidian cases, without abatement, unless in consideration of its effects upon the head, until the period for the second paroxysm is passed. The disease is then subdued; or at least all of it which belongs to the pernicious fever. The remaining treatment, if any is requisite, must be conducted as in ordinary cases.

Article III.

YELLOW FEVER.

Syn.—Typhus Icterodes (*Cullen*).—Bulam Fever (*Pym*).—Vomito Negro, Vomito prieto (*Span.*).

This is a peculiar disease, prevailing only within limited districts, and at certain seasons of the year. An average temperature of 79° or 80° F., continued for two or three months, appears necessary for its production. It is, therefore, a disease of hot weather and warm climates. The season at which it usually appears is the latter part of summer and beginning of autumn; and it always ceases with the occurrence of frost. It is very seldom met with north of 40°, because, though the summer heats may be very great, they are not sufficiently long continued. Nor is it diffused uniformly within its recognized limits. A singular and important fact in relation to this disease is, that it is confined almost exclusively to towns, or other situations where human beings congregate, as to garrisoned forts, or ships. It is chiefly, moreover, in towns upon the sea-coast, or upon streams emptying into the ocean that it is met with. It seldom shows itself, as a prevailing disease, in a scattered population, or at a distance from navigable rivers. Another interesting fact is, that it does not occur in all countries, where the circumstances apparently favourable to its production exist in an equal degree. Thus, while it is exceedingly common in the sea-port towns of intertropical America, and not unfrequent in those of south-western Europe, it is almost unknown in those of Asia, eastern Africa, and south-eastern Europe. We never hear of it in Canton, Calcutta, Alexandria, Smyrna, or Constantinople; while every one is familiar with its ravages in Vera Cruz, Havana, New Orleans, Gibraltar, and Barcelona. The relative frequency of its occurrence in its different sites bears some proportion to the duration and intensity of the hot season. Thus, in many cities of the West Indies, and of the Mexican coast, it is scarcely ever absent during the hottest period of the year; in New Orleans, Mobile, and Charleston, though exemption can never be counted on, yet the disease does not prevail every summer; and in Baltimore, Philadelphia, and New York, it makes its appearance only at distant intervals. In the more southern latitudes it may be considered as endemic, in the northern as in some measure epidemic.

Yellow fever exhibits a great diversity of phenomena. Epidemics of it, occurring in different places, appear, from the testimony of eye-witnesses, to have been marked by very different characters. Miasmatic exhalations have impressed upon it, in some instances, a close analogy in its symptoms and course with ordinary bilious fever. The effluvia generated among the filth of congregated masses of people, may be readily supposed to have occasionally given it a typhous form. The scorbutic tendency of system, generated in garrisons and ships, must have often modified its symptoms. To describe minutely all the varieties arising from these, and other similar causes, would be incompatible with the objects of this work. An acquaintance with the characteristics of the disease, in its ordinary form, and with the morbid effects of the causes alluded to, in connexion with the obvious influences to which the patient may be exposed, will generally enable the practitioner to detect and discriminate its various complications. As in most other fevers, the state of system may in this be sthenic or asthenic, inflammatory or typhous. Owing to the different susceptibilities of individuals, and the variable intensity of the cause, there is every grade of violence, from a mildness in no way alarming, to the most fatal malignancy. Curious and inexplicable anomalies also not unfrequently occur, which defy classification. I shall first describe the disease as it most commonly appears, and then refer briefly to its diversities.

Symptoms, Course, &c.—The attack is sometimes preceded by the usual preliminary symptoms of fever (see *page* 88), but perhaps quite as frequently comes on abruptly, in the midst of ordinary health. It is said to occur very frequently in the night. There is usually some chilliness at the commencement, seldom, however, amounting to rigors or shivering; and this symptom is often altogether wanting. Among the most characteristic phenomena of the incipient stage are severe pains in the back and limbs. After febrile action has become established, the skin is hot and dry, the pulse frequent, the respiration hurried, the face flushed, and the eyes red and watery. The tongue is usually moist and covered with a white fur, and the throat occasionally sore, so as to render deglutition difficult. Nausea or other uneasiness of the stomach, with or without vomiting, not unfrequently attends the disease from the commencement; but, in the majority of cases, the gastric symptoms are not fully developed until after the lapse of some time, perhaps from twelve to twenty-four hours, when they become very prominent. The patient complains of a burning pain, or a feeling of weight or tension, or a vague sense of oppression in the epigastrium; pressure upon this region generally occasions severe pain; and the stomach is exceedingly irritable, often rejecting everything that is swallowed, and throwing up its own morbid contents when undisturbed. The act of vomiting is often violent, with retching, and much distress from the extreme tenderness of the stomach. Flatulence is also occasionally a troublesome symptom. The desire for cold drinks is usually extreme; and ice, held in the mouth and slowly swallowed, is very grateful, in consequence of the intense gastric heat. The bowels are ordinarily costive, and sometimes obstinately so; and, when discharges are obtained, they are generally unhealthy in appearance and offensive. But the nervous symptoms are probably those from which the patient suffers most. There is almost always headache, generally in the forehead and eyes, and sometimes confined to one side. This is often exceedingly violent, and continues in a greater or less degree through the whole period of febrile excitement. The pains in the back and limbs also, which often usher in the disease, continue after the fever has been fully formed, and are sometimes insupportably severe, extorting groans and even screams from the patient. The mind is usually much disturbed in this stage. The patient is apprehensive, anxious, and exceedingly restless; and the countenance is strongly marked with the expression of these feelings. Delirium is not an uncommon symptom; and shows itself in various degrees, from slight mental confusion to maniacal violence, with a wild fiery look, and uncontrollable movements. Sometimes there is a greater or less degree of stupor, through which, when short of coma, the signs of distress show themselves as through a veil.

These febrile symptoms continue, usually with little or no remission, for a period varying from a few hours to three days, and sometimes even longer. The duration is shorter in the more violent cases, and longer in the mild; and in the latter is sometimes extended to four or five days, with a greater tendency to remission. Having run its course, the fever subsides, and a great apparent amelioration of the disease is experienced. The skin becomes cooler and softer, the pulse nearly or quite natural, the respiration calm, and the stomach comparatively quiet. The headache, and the excruciating pains in the back, if not previously relieved, disappear; and the patient, freed from the distress of body and mind, becomes comparatively cheerful and hopeful, and not unfrequently confident of recovery. It is not unusual to find him sitting up, either in or out of bed, and to be told by him that he is quite well. But this is a delusive calm. Sometimes, indeed, convalescence dates from the subsidence of the fever, in mild cases; but generally the great struggle is yet to come. This apparent amelioration is not, in any respect, comparable to the remission or intermission of miasmatic fever. The disease still continues unabated. It is only that the febrile phenomena have disappeared under the failing powers of the system. The struggle against the noxious influence has ceased for a time. The continuance of the fever would be a favourable rather than an unfavourable sign; as it would evince a greater ability of the system to cope with its ferocious adversary.

There are phenomena, even during this temporary calm, which evince the existence of undiminished danger. Upon pressure in the epigastrium, the tenderness, instead of being diminished, is often found to be greater even than before. The redness of the conjunctiva, and the flush of the face may be gone; but in their place is often a yellowish or orange colour, which gradually extends itself from the forehead and eyes to the face, neck, and chest, and ultimately, in a greater or less degree, over the whole body. The urine also has a yellow tinge, which, even though the discharge may appear in mass of a dark-brown colour, may be detected when it is in thin layers. The pulse is sometimes even slower than in health, and has been known to descend to 40 in the minute. In bad cases, there is sometimes a little heaviness or stupor. This period of apparent abatement may continue but a few hours, or may be protracted for twenty-four hours.

Another class of phenomena now ensue; those, namely, of debility or prostration. In severe cases the weakness is extreme. The pulse is quick, irregular, and feeble; the skin is yellow, orange, or of a bronzed aspect; the blood appears often to be nearly stagnant in the capillaries, so that, when removed by pressure with the finger from a portion of the skin, the colour returns very slowy; the dependent and extreme parts of the body, as the fingers, toes, scrotum, and back, become of a dark purplish hue. The tongue is now often brown and dryish in the centre, or smooth, red, and chapped; and sordes occasionally collect about the gums and teeth. The stomach resumes all its former irritability; everything swallowed is thrown up again; and a new matter is ejected, consisting of brown or blackish flakes or particles diffused in a colourless liquid, which may be at first slightly tinged by them, but ultimately becomes black and opaque. In very malignant cases, the condition of system above described may come on even so early as the first day; and occasionally, the extreme capillary prostration, with the purplish skin, and a pulse scarcely perceptible at the wrist, ensues, while the heart and large vessels are still beating tumultuously. The urine, often scanty and high-coloured during the fever, is now sometimes nearly natural, sometimes almost or quite suppressed, and occasionally, though rarely, retained. At this stage of the disease, hemorrhage occasionally takes place from various parts of the body, especially from the mucous membranes. Blood oozes from the gums, the fissures in the tongue, the fauces, and the nostrils. It is sometimes also vomited, or discharged by stool, or with the urine; and petechiæ and vibices, arising from its extravasation, appear upon the skin. The irritability and extreme distress of the febrile stage are now replaced by an extraordinary apathy; and the countenance expresses a quiet resignation, or gloomy indifference. The pulse at length almost ceases; the respiration becomes slow, sighing, and occasionally interrupted by hiccough; the skin assumes a cold and clammy feel; the bowels often give way, and discharge large quantities of black matter, similar to that ejected by the stomach; low delirium sets in; an offensive odour sometimes exhales from the whole body; the eyes become sunken, and the countenance collapsed; and death takes place, often quietly, but sometimes in the midst of convulsions. Black vomit, yellowness of the skin, and hemorrhage, have been mentioned as attendants upon this last stage; but patients often die without them.

Instead of pursuing this fatal course, the system very often reacts after the period of abatement, and a secondary fever sets in, which may be of various grades of violence, but may always be regarded as a salutary effort of nature, or at least as a sign that the vital energies are not yet exhausted. This febrile affection continues, without any special or peculiar symptoms, a variable length of time; sometimes speedily terminating in health, with the ordinary signs of convalescence, sometimes ending in fatal exhaustion, and occasionally running into a typhoid form, which may last, with variable results, for two or three weeks or more.

When convalescence takes place from severe cases of yellow fever, it is commonly tedious, in consequence of the amount of repair which is necessary to restore the dilapidated organs; and the patient is often incommoded, in the course of it, by obstinate and unhealthy sores or abscesses in various parts of the body.

From a review of the course of yellow fever, as above described, it will appear that it has usually three distinct stages. The first is that of the primary febrile action, which continues from a few hours to several days, on the average, perhaps, from thirty-six to sixty hours. The second is that of subsidence or abatement, in which the exhaustion of the excitability leaves the system in a state of temporary repose, and which may continue, in a greater or less degree, from twelve to twenty-four hours. The third stage is that of secondary fever, or collapse, according as the system has or has not the strength to rally under the depressing influences to which it is subjected. In fatal cases, death takes place most frequently on the fourth, fifth, or sixth day, though sometimes as early as the third, and sometimes as late as the ninth or even the eleventh. In some rare instances, in which the disease runs into a protracted typhoid form, it may be considerably postponed.

It has been already stated that the disease is liable to great diversity. Most frequently the action in the first stage is inflammatory or sthenic, with a full, strong, and sometimes tense pulse. In other instances, the state of system is asthenic from the commencement; the pulse being very frequent and feeble during the febrile excitement, or the general strength being inadequate to rally from beneath the first force of the blow, and the symptoms at the beginning being those of great prostration, especially of the whole capillary system. In the fashionable language of the day, these cases are denominated congestive. Universal weakness, with obscure, and as it were paralytic pains in the back and lower extremities, and a sense of weight or stupefaction in the head; the skin dry, unctuous, or perspiring, without tone, and without heat, unless near the centre of the body; the pulse sometimes frequent, and sometimes full, but often slow, always feeble, and occasionally almost wanting at the wrist, while the heart and carotids may be throbbing tumultuously; the face pale or purplish, with an expression of countenance either stolid and apathetic, or sullen, or such as usually indicates a feeling of horror or intense agony; these are some of the symptoms which mark the most malignant cases. Occasionally the system evinces a disposition to rally, and signs of febrile action are exhibited; but these for the most part quickly give way, and complete collapse ensues. Copious black vomit, occasional hemorrhage and petechiæ, a dark mahogany or bronzed colour of the surface, and an almost entire annihilation of sensibility, precede death, which often takes place on the third or fourth day.

Sometimes the patient is struck down suddenly with stupor or coma, and death is preceded by convulsions. Sometimes the most prominent symptoms are those of overwhelming precordial oppression, with a slow laboured respiration, and deep sighs and groans. Occasionally the force of the disease appears to be expended upon the stomach, producing incessant vomiting, with intense epigastric distress. In other instances, the animal functions seem to be at first almost untouched. The patient may be walking in the streets, and nothing call attention to his case, unless, it may be, an unusual expression of countenance. Upon his pulse being examined, it is found to be exceedingly feeble, if not quite absent at the wrist. Black vomit and death speedily ensue. These have been called *walking cases*. Again, there are instances in which the pulse is nearly natural, the tongue clean, and even the stomach calm, from the commencement; but great anxiety and distress, with excessive restlessness, give occasion for alarm; and the worst apprehensions are soon confirmed by the occurrence of black vomit and fatal prostration. Dr. Rush used to warn his pupils against the natural tongue, and the natural pulse in yellow fever.

But it must not be forgotten that, while these terrible cases are not unfrequent during the prevalence of this pestilence, there are others also in which the disease puts on a very mild form, with the ordinary symptoms of moderate febrile excitement, which subside in three, four, or five days, very often with perspiration, leaving the patient quite convalescent; and that between these two extremes there is every possible diversity of grade.

In some epidemics, an eruptive affection, of the character of a rash or papulus, has been noticed, during the first stage, upon the face, neck, and upper part of the body. Dr. C. H. Stone, in his account of the yellow fever which prevailed at Natchez in 1848, states that the breath was generally offensive. (*N. Orleans Med. and Surg. Journ.*, v. 560.)

It will be proper, before closing an account of the symptoms, to call attention to some of the more prominent of them severally.

The *pulse* is usually, in the inflammatory cases, and in the febrile stage, from 100 to 120, with considerable force, and sometimes tense. Occasionally it is jerking and even bounding. In the more feeble cases it is often very frequent, from 120 to 140, for example; but at the same time small and weak. In the same kind of cases, it is in some instances very full, and may readily deceive a careless observer; but it may be at once distinguished by yielding with great facility under the finger, as if filled with air. In the second stage, it becomes slower, sometimes more so than in health, and is not unfrequently nearly or quite natural. In the last stage, it again increases in frequency, but is almost always rather feeble, and, in the prostrate condition, is small, extremely weak, often irregular, and sometimes nearly or quite absent for some time before death. In the asthenic cases, where there is little or no reaction, it may have this latter character from the commencement.

The *countenance* is peculiar in this disease. Allusion has already been made to its expression in different stages. But there is one characteristic condition which requires a more detailed notice. I allude to the colour of the conjunctiva, and that of the face. Even in the earliest period of the disease, the white of the eye is often reddened and turbid, and in bad cases appears sometimes almost as if bloodshot. At the same time the forehead and upper part of the face have a reddish colour, inclining somewhat to purple. I have never observed these phenomena so strikingly in the early stage of any other idiopathic fever as in this. They are, however, not always present. As before stated, this redness yields, in the course of the disease, to a yellow or orange colour.

The *yellowness of skin* to which the disease owes its ordinary name, though a common, is by no means an invariable symptom. It begins usually about the third or fourth day, often with the commencement of the second stage. Appearing first in the conjunctiva, it extends successively to the forehead, face, neck, and chest, and sometimes affects the whole surface. It is said to be sometimes more intense and universal after death than before it. The tinge varies with the natural colour of the skin and the grade of the disease, from a deep lemon-yellow to an orange colour, or even the hue of bronze; the latter being ascribable to its admixture with the dark-red colour of the stagnant blood. Sometimes the colour is imparted to the perspiration, and tinges a handkerchief yellow. Different opinions have been entertained as to its origin. It is probably dependent upon a change in the blood, giving rise to an excessive production of the same colouring principle that imparts yellowness to the bile. It often affects the cellular and adipose tissue, as well as the skin, and has been observed in the bones. The same colouring matter is thrown out with the urine. In bad cases, the surface is often covered with petechiæ before death. In those of a milder character, Dr. Magruder noticed, in an epidemic which prevailed at Vicksburg in 1847, the frequent occurrence of a lichenous or exanthematous eruption, which was the precursor of convalescence. (*N. Orleans Med. and Surg. Journ.*, iv. 691.)

The *black vomit*, so striking a symptom in this disease, does not usually make its appearance until in the second or third stage. The matters ejected from the stomach are at first such as have been swallowed, and afterwards usually a little bile, probably from the gall-bladder, and the vitiated secretions of the stomach itself. These are sometimes so acrid as to inflame and excoriate the œsophagus and fauces. The black vomit appears often at first in small quantities, and sometimes as if not fully formed, the flakes being less intensely black than they afterwards become. At least I observed this phenomenon, during the fever of 1820, in Philadelphia. It afterwards increases, and the quantity discharged is often enormous. The mode in which it is thrown up differs from ordinary vomiting. It appears to gush forth, as if without effort on the part of the patient, and sometimes almost without his consciousness; being not unfrequently discharged upon the bedclothes. Sometimes it is ejected by mouthfuls, by a sort of regurgitation, and portions of it come up occasionally with hiccough. There are cases in which, though this matter may exist in the stomach, very little is discharged, in consequence of an utter loss of power, or of sensibility in the gastric coats. In such cases, a loud gurgling sound can often be heard upon every movement of the patient's body, owing to the presence of air and liquid together in the stomach; and there is often considerable fulness or distension of the epigastrium.

Black vomit is either nearly tasteless, or sour; and to chemical tests is in general decidedly acid. Formerly, it was thought to be black bile. Dr. Physick suggested that it might be a secretion from the stomach, and supposed that it was thrown out in order to relieve the inflamed vessels. At present, it is believed to be blood somewhat altered, either by a feeble secretory action of the membrane, or by the acid which exists in the stomach. I am inclined to the opinion, that the blood undergoes some modification either in the capillary vessels, or in its exit from them through the epithelium. Were the character of the black vomit dependent on the reaction of gastric acids, as is supposed by some, it should be changed for that of unaltered blood upon the free exhibition of magnesia, instead of remaining unaffected, as it actually does. Black vomit, though apparently homogeneous when discharged, separates upon standing into two parts; an insoluble black flaky matter, like coffee-grounds or soot, which subsides, and a clear viscid liquid, which occupies the upper part of the vessel. The insoluble matter is probably the altered solid and coagulable matter of the blood, the clear liquid its serum. Dr. Rhees, of Philadelphia, discovered innumerable animalcules by means of the solar microscope. "When the matters fresh thrown from the stomach were examined, the animalculæ were alive, and in constant motion; but if taken from the dead subject, or inspected after standing some time, they were always dead and quiescent. Comparative examinations were made of the discharges from the stomachs of patients ill with autumnal bilious and remittent fevers, but no similar appearances were discovered." (S. Jackson, *Phil. Journ. of Med. and Phys. Sciences*, ii. 23.) In a communication to the *London Lancet* (see Am. ed., Feb. 1853, p. 192), Dr. Manly states that he has repeatedly noticed animalcules in black vomit, belonging to the genus Acarus, but of unknown species; but other observers have failed to find the appearances noticed by Dr. Rhees; and the presence of animalcules certainly cannot be considered as in any degree characteristic. Black vomit has recently been submitted to careful microscopic examination by several observers, among whom may be mentioned Dr. J. L. Riddell of New Orleans, Dr. M. Michel of Charleston, S. C., Prof. A. Clark of New York, Dr. Hassall of London, and Dr. Leidy of Philadelphia, with results confirmatory of the views above given as to the nature of this morbid product.* Besides the different epithelial cells of the mucous membrane, which are found in different stages of developement and disintegration, the most prominent constituents are blood corpuscles variously altered, and a black granular or amorphous matter, probably resulting from the breaking up of the solid ingredients of the blood. Microscopic fungi have also been noticed; but they were not uniformly present, and were probably developed by changes in the black vomit after its production. Specimens examined chemically by Prof. R. E. Rogers, of Philadelphia, at the request of Dr. La Roche, were found to contain, besides free muriatic acid, many of the constituents of the blood, especially albumen and iron. (*Am. Journ. of Med. Sci.*, N. S., xxvii. 308.) There can be little doubt, therefore, that the proper black vomit of yellow fever is essentially disintegrated blood.

Anatomical Characters.—The blood drawn during the progress of the disease is almost always coagulable, and sometimes sizy; but the clot is usually softer than in health, and the buffy coat, when it occurs, is often of a gelatinous consistence. It has been thought that, in malignant cases, the blood loses in great measure its vitality, becoming dark-coloured and dissolved. This may sometimes be the case, and, in most instances, the coagulability of that fluid is impaired. Upon examination after death, it is often observed in a liquid state, distending the veins, especially those connected with the portal system; but Dr. Hewson found that this blood, when removed from the body, coagulated upon standing ten or fifteen minutes. (*Phil. Journ. of Med. and Phys. Sci.*, ii. 22.)

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* See, for the results of Dr. Riddell's observations, the *N. O. Med. and Surg. Journ.* (ix. 420); for those of Dr. Michel, the *Charleston Med. Journ. and Rev.* (viii. 333); for those of Prof. Clark, the *N. Y. Med. Times* (ii. 230); for those of Dr. Hassall, the *London Lancet* for February, 1853; and for those of Dr. Leidy, the *Am. Journ. of Med. Sci.*, N. S. (xxvii. 312). The reader is also referred to an elaborate and excellent paper by Dr. R. La Roche on the black vomit of yellow fever, contained in the last mentioned journal (vol. xxvii. pp. 13 and 295).

It is unnecessary to give a detailed account of the changes observed after death in all the organs. As in other febrile diseases, signs of congestion or inflammation are occasionally discovered in various parts of the body. Thus, the membranes of the brain are often injected, and serum effused into the ventricles. The lungs, though generally healthy, sometimes show signs of sanguineous engorgement. Traces of inflammation are occasionally noticed in the kidneys and bladder. The liver is variously affected, being sometimes engorged with blood; sometimes dry, anemic, and of a yellow colour; rarely inflamed. The spleen is not materially affected, though occasionally engorged with blood. The chief force of the disease obviously falls on the alimentary canal, especially on the stomach. The œsophagus is sometimes found inflamed, and deprived of epithelium, probably from the acrid matter vomited.

The stomach generally contains more or less of the matter denominated black vomit, even in cases in which none was discharged during life. Sometimes it is distended with this fluid. Occasionally it contains blood in different stages of alteration. According to Gillkrest, there is sometimes to be seen, adhering in large quantities to the mucous coat, a deep-black homogeneous substance, of a gelatinous consistence. The muscular and peritoneal coats are usually sound; but the mucous coat is in general partially or universally reddened, sometimes thickened and softened, and sometimes, though rarely, eroded. The cardiac portion is usually more affected than the pyloric. Sometimes the membrane is wholly free from any signs of inflammation, or other appreciable lesion. (Harrison, *N. Orleans Med. & Surg. Journ.*, Sept. 1845.) Dr. Nott found this to be the fact in four out of eight cases examined by him at Mobile, in 1843. (*Am. J. of Med. Sci.*, N. S., ix. 279.) The bowels often contain the characteristic black matter of the disease, though less liquid than that of the stomach; and their mucous membrane generally exhibits signs of inflammation here and there in patches. The glands of Peyer are seldom materially altered. The veins of the omentum and mesentery are usually distended with fluid blood.

Some importance has been attached to the appearance of the liver, in consequence of the observations made by Louis in the yellow fever of Gibraltar, in the year 1828. In all the cases examined by that celebrated pathologist, the liver was found in a peculiar friable, dry, anemic condition, paler than usually in health, and of a yellow colour. The same phenomenon was observed by Dr. Stewardson, of Philadelphia, in a case examined by him in the Pennsylvania Hospital. (*Am. J. of Med. Sci.*, Jan. 1842.) It was supposed that this state of the liver might be characteristic of the disease. But examinations, made both previously and subsequently to those of M. Louis, prove that the lesion is by no means universal. Thus, Dr. S. Jackson, of Philadelphia, found the liver sometimes gorged with blood, sometimes quite anemic. (*Phil. J. of Med. and Phys. Sci.*, ii. 21.) The same observation was made by Dr. Harrison, of New Orleans, who ascribes the pale yellow colour sometimes observed chiefly to the loss of blood. (*N. Orleans Med. and Surg. Journ.*, ii. 138.) Dr. Lewis states that he has observed the dry, brittle, straw-coloured liver, in most cases which had been attended with profuse hemorrhagic discharges. (*Ibid.*, iv. 161.) According to Dr. Dickson, of Charleston, the liver presents no constant appearances, being in some instances engorged with blood, in others soft, pale, and flabby, and in others again natural, so far as the eye could judge. (*Essay on Pathol. and Therap.*, i. 357.) Dr. Nott found the yellow anemic condition present in only about one-third of the cases. (*Am.*

Journ. of Med. Sci., April, 1845.) Recent microscopic observations by Prof. Clark, of New York, and Drs. T. H. Bache, Rhoads, Darrach, and Green, resident physicians of the Pennsylvania Hospital in Philadelphia, have shown that a great excess of oil generally exists in the liver, both free and within the proper hepatic cells, in which they frequently replace the nucleus; so that fatty degeneration of that organ may be considered as one of the characteristic lesions in fatal cases of yellow fever.*

In various parts of the body extravasation of blood has been observed, especially in the cavities, and in the pulmonary parenchyma.

Cause.—There can be little doubt that the cause of yellow fever is peculiar and specific, as much so as that of smallpox or scarlatina. But great diversities of opinion have existed upon this subject. Some of these it will be proper to examine in this place.

A very prevalent hypothesis has been, that the causes of yellow and bilious fevers are identical; in other words that the former disease, as well as the latter, proceeds from marsh miasmata. The chief arguments in favour of this notion are, that the two diseases prevail in hot countries, and at the same season of the year; that when the yellow fever becomes epidemic, the bilious fever is also apt to be peculiarly rife; that acclimated individuals are less liable to the attacks of both than the unacclimated; and, finally, that no essential difference exists between the symptoms and course of the two diseases. But these arguments will not bear examination.

It is true that the two fevers prevail in hot countries, and in hot weather. So do cholera, dysentery, and hepatitis; yet no one considers these as identical with yellow fever. But, though heat is essential to both, their localities, and other circumstances in relation to their prevalence, are very different. Bilious fever occurs abundantly, and even malignantly, in many situations where yellow fever is never seen. Thus, the former disease is not less prevalent, nor less fatal, in Asia, Eastern Europe, and eastern Africa, where the latter is seldom heard of, than in the West Indies and other parts of tropical America, where it is very common. Bilious fever is quite as prevalent, and quite as violent, in the interior of miasmatic countries as near the sea; yellow fever seldom occurs at any considerable distance from the sea-coast, or the borders of navigable streams. The latter disease is almost always confined to a dense population, as for example to cities and garrisons; one of the most striking circumstances in relation to the former is, that its cause appears to be neutralized by the atmosphere of cities. Thus, Rome is healthy, while the plains about it are devastated by miasmata.

It is also true that the yellow and bilious fevers are apt to prevail at the same time, the former in cities, the latter in the country. But this is not always the case. Dr. Dickson states that, at Charleston, the yellow fever has often raged violently in the city, when the surrounding country was either not more sickly than usual, or remarkably exempt from disease.

Though acclimated persons are less liable to both diseases than strangers, yet this difference of susceptibility is infinitely greater in the yellow than the bilious fever. The former very seldom attacks an adult native in places where it is endemic, however fatally it may rage among strangers; while no part of the population is entirely exempt from the latter in its localities.

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* See Prof. Clark's paper in the *N. Y. Med. Times* (ii. 234), and a paper by Dr. T. H. Bache in the *Am. Journ. of Med. Sci.*, N. S. (xxviii. 124). The latter communication is peculiarly interesting, giving the results of the microscopic examination of the liver in fourteen cases which proved fatal in the summer of 1853 in the Penn. Hospital, in all of which, as well as in several others in which the liver was sent to the Hospital for examination, this fatty degeneration was uniformly noticed.

It is not true that the symptoms of the two diseases are the same, at least in their well developed forms. They are, on the contrary, strikingly different. Though perfectly familiar with bilious fever, when I first saw a case of yellow fever, I was at once struck with the latter as something that I had never seen before. The febrile stage of yellow fever is continuous, like that of smallpox or measles, for one, two, or three days, and then ceases; while bilious fever has a tendency to remission or intermission every day, or every other day, to the end of the disease. In the latter, the secretion of bile is usually increased, in the former diminished. Though it is possible that the turbid conjunctiva, and purplish flush of the upper part of the face, so common in yellow fever, may occur in some cases of the bilious, they are uncommon in the latter, and I have never seen them in an equal degree. Gastric inflammation, though common to the two diseases, is much more striking, as a general rule, in the yellow fever. The black vomit of this disease is entirely different from the black discharges of bilious fever, which are homogeneous, and consist of altered bile, not altered blood. Uncomplicated yellow fever never ends in regular intermittent; while this is an exceedingly frequent termination of bilious fever. It has been said that yellow fever is an aggravated form of the bilious; but this is not so. Many cases of the former are as mild as the mildest of the latter; and bilious fever is sometimes quite as malignant as the worst form of the yellow; yet, in both instances, the characteristic difference of symptoms is observable.

An autumnal attack of bilious fever, so far from giving any future exemption, is well known to dispose to a second attack in the following spring. The case is exactly the reverse with yellow fever. This disease rarely occurs more than once in the same person. It is true that this fact is denied by some; but it appears to me that no impartial person can read the testimony upon the subject, and refuse credence to the statement. Second attacks of yellow fever are probably not more frequent than second attacks of smallpox; and, when they do occur, are generally light.*

It is very possible that the causes of the yellow and bilious fevers may sometimes co-operate, and thus produce modified cases. A patient may be attacked with yellow fever, while labouring under a remittent or intermittent, which will thus assume the characters of the former; or a predisposition to intermittent may exist which will exhibit itself after the cessation of the more violent disease. Cases of this kind have undoubtedly occurred, and lent some countenance to the notion of the identity of the two fevers.

Dissection presents somewhat different phenomena in yellow and bilious fevers. The stomach is inflamed in both, but in the latter seldom if ever contains the true black vomit. The liver in yellow fever is often bright yellow, dry, and anemic; in the bilious, it presents wholly different phenomena. (See *Bilious fever.*) The gall bladder in the latter is usually distended with black bile, in the former is seldom distended, and often contains less than in health. The spleen, in bilious fever is almost always enlarged and softened, in the yellow it is often little if at all changed.

From these considerations, it appears clear to me that these two diseases are quite distinct, and arise from wholly distinct causes. What, then, is the nature of the cause in yellow fever? Is it, as many have supposed, a peculiar contagion? Few questions in pathology have been more largely, and more warmly discussed than this, which, therefore, requires a particular notice here.

The *contagious nature* of yellow fever has been maintained upon the grounds, 1. that it almost always occurs near wharves where vessels arrive from abroad and unload; 2. that it has thus been carried to isolated spots, where the disease had never been known to prevail before; 3. that individuals, going from an infected neighbourhood into a healthy one, have become the centres of a new infection; and 4. that, like contagious diseases in general, it cannot be taken a second time.

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* It must be recollected that second attacks of smallpox, in a modified form, are not very uncommon during epidemic visitations of that disease.

But these arguments are met by powerfully opposing facts. Thus, in hospitals situated in healthy districts, though crowded with yellow fever patients, the disease is never imparted to the nurses and other attendants. From vessels arriving in healthy ports yellow fever patients are often landed, sometimes in considerable numbers, without propagating the disease.* In cities where the disease prevails within limited districts, only those persons are attacked who reside in or visit the infected spot; and patients, seized in consequence of such exposure, and carried into healthy parts of the city, do not impart the disease to those about them. Hundreds of instances occur, in extensive epidemics, in which patients originally seized in cities are scattered through the country; and yet the instances are exceedingly rare, in which it is even pretended that the disease is thus communicated. Attempts have been made to propagate the disease by inoculation with the blood and secretions of those affected, but without success; and even the black vomit has been swallowed with impunity. It is obvious that the argument drawn from the exemption afforded by one attack of the disease is only analogical, and is deserving of no weight unless supported by positive facts.

For these and perhaps other reasons, the great majority of physicians who have had any opportunity of seeing yellow fever, altogether deny its contagious nature. This fact is rendered incontestable by the industry of the late Dr. Chervin, who personally collected the written opinions of almost all the practitioners who had seen yellow fever in portions of the West Indies, and on the Atlantic coast of the United States. The number was very small of those who expressed a belief in the existence of a contagious cause. It must not be denied, however, that this number has lately somewhat increased. The contagionists meet the opposing facts above stated by admitting that the disease is seldom imparted from one individual to another in a pure and perfectly healthy atmosphere; and that it requires a certain corrupted condition of the air, in order that the personal effluvia may produce their effect. But this is contrary to all that we know of other admitted contagious diseases. There is not one of them which may not be imparted, in the purest state of the atmosphere, provided the contiguity be sufficiently close. It seems to me that the doctrine of the contagiousness of yellow fever, in the ordinary meaning of that term, is quite untenable.

Can it be that the cause is a peculiar miasm, distinct from that which produces bilious fever, but resembling it in being a product of the decomposition of organic substances? Marsh miasm is supposed to result from vegetable putrefaction. That which produces yellow fever, if it be a miasm, must in some way be connected with animal matter; for it is generated, or at least is effective only where men congregate. Hence its origin in cities, garrisons, and occasionally in ships. In all these situations we have animal effluvia, or animal excrement, often mingled with vegetable matter in decay. Along wharves, and in docks into which the common sewers empty, we have these conditions in an eminent degree, ready to be called into operation when a high and long-continued temperature shall penetrate to the bottom of the water, and set the fermentation into movement; and it is well known that these are the parts of cities where the yellow fever is most apt to break out. We hear nothing of yellow fever in the Spanish encampments on the Mexican coasts, during the conquest. It was only after cities sprang up that it made its appearance. In favour of the supposition of a miasm thus generated, are the facts that, as in ordinary remittents and intermittents, the cause is most energetic in the night, or in the evening and morning, while the ground and adjoining water are covered with fog or mist; that it seldom in temperate latitudes begins to exert its influence before the season when dew forms at night; and that it often gradually diffuses itself in all directions from some central spot. But, if the cause be a miasm, as supposed, how does it happen that this is not generated wherever the conditions above mentioned exist? Why, for example, is it not produced in Calcutta, Cairo, Rome, &c., as well as at Havana, New Orleans, Philadelphia, or Gibraltar? Why is it occasionally developed in isolated spots, upon the arrival of an infected ship, though never known to exist in these spots before? Why is it sometimes communicated from one ship to another? We can easily understand that a vessel, with foul bilgewater in her hold, and a crowded crew, in a hot climate, may generate a febrific miasm; or that another vessel sailing from an infected port may carry the poison shut up with the air under its hatches. We can also understand that either of these vessels, arriving in a port, may give the disease to those who may visit it, and breathe its foul air. But how explain that the disease shall then spread over a considerable space, and prevail for a considerable time, after the vessel has been thoroughly cleansed, or removed, and the air proceeding from her thoroughly dissipated?

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* See letters of Dr. Geo. A. Smith and Dr. W. J. Tuck, of Memphis, Tenn., in the *N. O. Med. and Surg. Journ.* (x. 662.) It is here stated that in the year 1853, when yellow fever prevailed epidemically with great violence in New Orleans, and various other towns on the Mississippi river below Memphis, it did not reach the last mentioned town, nor any point above it, in the epidemic form. It happened, however, that sixty-two cases of the disease were landed at Memphis from the towns below, and carried through the streets of the city in open vehicles for a mile to the hospital; yet in no instance, either within the hospital where they were distributed indiscriminately among the patients, or in the city at large, was the disease communicated.

Two theories have been advanced, either of which will explain these apparent anomalies, though it must be admitted that further proof is requisite before either can be received. According to one of them, a peculiar product is generated under the circumstances before mentioned, which is capable of acting as a ferment when it finds the proper materials to act upon, and of reproducing itself, or a substance identical with it out of these materials, as yeast is generated during the vinous fermentation which yeast has set in motion. The other theory supposes the cause to be a living, organized, microscopic being, either animal or vegetable, which, produced out of pre-existing germs, under favourable circumstances, is capable of propagating itself indefinitely when these circumstances exist. According to either of these views, the ferment, or the developed germ, may be conveyed in ships, or even in the clothing of individuals, from one spot to another; and, if it find the proper material to act upon, or the proper food to support it, with the temperature essential to its activity, may spread itself indefinitely, and, though perhaps originally little more than a mere point, may poison the atmosphere of a whole city. Thus is explained the conveyance of the disease from place to place, without the necessity of appealing to the medium of contagion. That it is not more frequently propagated to interior cities, may be owing to the less likelihood of the conveyance of the poison in the clothing of an individual than in the confined air of ships, where it may possibly be kept in existence by the same power of propagation. In favour of the theory which ascribes the disease to organic germs, is the fact, that it is endemic or original only in a comparatively small portion of those regions of the world, where all the exterior circumstances would appear equally to favour its production. Organic germs have been planted by the Creator in certain parts of the earth; and that of the cause of yellow fever, supposing it to be organic, may have been originally limited, by the same fiat which produced it, to the warm latitudes of America. That it has reached Philadelphia and New York, upon this continent, and Gibraltar and Barcelona upon the old, rather than the more distant ports of the Mediterranean or the East Indies, may be owing to the less mercantile communication of the latter with the places of its production, or simply to their greater distance.

But, whatever the special cause of yellow fever may be, it appears to be aided, in many instances, by a kind of epidemic influence, which prevails sometimes in a greater or less degree for years together, sometimes only at long and irregular intervals, and may be confined to one locality, or may spread over extensive regions. Thus, from the year 1762, when the yellow fever raged in Philadelphia, we hear nothing of it in the same city until 1793, after which it appeared occasionally until 1805. From the last-mentioned date until 1819, there was an almost complete exemption. In 1819 and 1820, the disease appeared in most of our large cities upon the Atlantic coast, from Charleston to Boston; and in 1853 again made its appearance in Philadelphia, which had in the meantime been nearly exempt. This epidemic constitution only gives efficiency to the specific cause, and therefore never produces the disease when that cause does not exist. Perhaps a long continued elevation of temperature may contribute to this epidemic influence; but it is not alone sufficient, for there have been years of exemption, hotter than those in which the disease prevailed.

Certain conditions appear to act as predispositions to the disease, and others to afford more or less protection against it. It has already been said that strangers, in situations where the disease is endemic, or prevails very frequently, are more liable to it than natives or old residents. Among the natives, children are much more apt to be affected than adults, who enjoy an almost entire exemption. Residents in places only occasionally attacked, and at distant intervals, are not more exempt than strangers. Females are said to be less liable to the disease than males; probably, however, because less exposed to the cause. Negroes are certainly much less under the influence of the morbific cause than the whites. They are not only less frequently attacked, but are also more mildly affected when attacked. The comparative exemption of adult natives, in the situations above alluded to, may be ascribed in some instances, to their having once had the complaint, which seldom occurs twice in the same individual; but, in the greater number of cases, probably, to a gradual action of the cause from infancy, which has worn out the susceptibility to its influence, without having ever absolutely produced the disease.

Various circumstances operate as exciting causes, calling into action the efficient and specific cause, which may have been lurking in the system. Anything which considerably disturbs the condition of the system may have this effect. Among these causes may be mentioned exposure to cold and wet, or to the night dews, fatigue, intemperance in drinking, and excesses of all kinds. The influence of a sudden accession of cold weather in favouring the attack of the disease has been often noticed. Thus, though frost puts at once an end to the cause, yet it augments for a time the number of cases, by developing the disease in those upon whom the cause has already acted.

Nature.—The reasons have been before given, why this disease should not be considered as a variety of bilious fever. Dr. Physick, whose post-mortem investigations established the very frequent existence of inflammation of the stomach, was disposed to regard gastritis as the essential part of the complaint. But the symptoms and course of the disease clearly show that it is a mere attendant. Practitioners are everywhere familiar with gastritis; but yellow fever is seen only within comparatively restricted limits. Besides, dissections have shown that inflammation of the stomach, though very generally, is not universally present, at least not in a degree at all adequate to the results produced. There can, I think, be no doubt, that yellow fever is an entirely peculiar and distinct disease. What are the precise pathological conditions essential to it are unknown. It is highly probable that the blood is prominently in fault, being deranged by the immediate action of the morbific cause.

Diagnosis.—The initial stage of most fevers has so many symptoms in common, that it is often very difficult, if not impossible, to discriminate between them in the outset. Yellow fever, for the first day or two, is not an exception to this rule. Nevertheless, there are often symptoms which may lead to a very probable inference as to the nature of the disease. The severe pains in the loins and lower extremities, the turbid conjunctiva, and the darkish-red suffusion of the upper portion of the face, are such symptoms. At a more advanced period, the excessive irritability of stomach and extreme epigastric tenderness; the regular continuance of the fever, and its subsidence after a duration of one, two, or three days; the supervention of yellowness of the eyes and skin, when the fever subsides; the great prostration, or the febrile reaction which follows the subsidence, and finally the occurrence of black vomit, are the most important diagnostic signs. In forming a judgment as to the nature of any doubtful case, reference must also be had to the circumstances under which it occurs; whether, for example, the disease is prevalent or not, whether the conditions necessary for its production are present, and whether the patient may have been exposed to the cause of it elsewhere.

Prognosis.—Yellow fever is a very fatal disease, being scarcely exceeded, in this respect, by any other acute febrile affection. It varies greatly in violence, at different periods and places of its occurrence. Sometimes it is so virulent, that the great majority of those affected perish; in other instances, it is mild, and few comparatively die. When it occurs epidemically, the first cases are generally the most severe, and sometimes almost all end fatally. Afterwards, the disease becomes milder, and, towards the close of the epidemic, it sometimes happens that almost all recover. Even within the same city, the violence of the disease may vary greatly in different spots. Thus, in Philadelphia, in 1820, out of twelve reported cases in one vicinity, there was only a single recovery, of seventy in another thirty recovered, and of four in a third three recovered. Perhaps the general average of deaths from yellow fever, prevailing epidemically, may be stated at one-third. Dr. Fenner calculates that about one-eighth of those attacked died in New Orleans, in the epidemic of 1847, which was, however, of a relatively mild character. (*N. Orleans Med. and Surg. Journ.*, v. 206.) According to Dr. Dickson, the proportion of fatal cases in Charleston is not more than one-fifth or one-sixth. The great experience of that distinguished practitioner gives weight to the following quotation from his work on Pathology and Therapeutics. "The attack is apt to be violent, and its progress hasty, in the sanguineous and plethoric. For the intemperate there is almost no hope. National habits and modes of life have a decided influence. The Irish, Germans, and Scotch afford us the worst cases; Spaniards, Italians, and Frenchmen, are very apt to recover. Midway stand the Englishman, the northerner, and the mountaineer, or inhabitant of our interior country. Generally speaking, the more recently a stranger has come here [Charleston, S. C.], the more severe his attack. Among the young children assailed, the ravages of this pestilence are very great." (*Page* 353.)

In individual cases, unfavourable symptoms are excruciating pains in the forehead, back, and limbs; great frequency and feebleness of the pulse, a gaseous state of it, or its entire absence at the wrist; a blood-shot appearance of the conjunctiva, and a bronze or mahogany colour of the skin; a short and violent febrile stage; coma or convulsions; a slow respiration with deep sighs; hiccough; excessive restlessness, and a disposition to get out of bed and walk; an unnatural apathy, or an expression of dogged indifference in the advanced stages; a voracious appetite; suppression of urine; a universal hemorrhagic tendency, with petechiæ; and, finally, the occurrence of black vomit. This last symptom is regarded as almost necessarily fatal; but occasional recoveries are mentioned by authors as having taken place after its appearance. Dr. Fenner estimates the chances of recovery at about one in a hundred cases. (*Hist. of the Yellow Fever at New Orleans in* 1853, p. 53.) A total suppression of urine may be regarded as a certainly fatal symptom in adults.

The absence of the above symptoms must of course be regarded as favourable. A prolongation of the primary fever beyond the accustomed period, the occurrence of a moderate secondary fever, and the appearance of a gentle diaphoresis at any period from the fourth to the seventh day, are also favourable signs. The production of strangury by blisters, and of salivation by mercury, may be regarded in the same light. The occurrence of dark bilious evacuations is sometimes a precursor of convalescence. The gradual cleaning of the tongue from the edges, along with a subsidence of vomiting, and a diminution of the epigastric tenderness, is highly favourable.

Treatment.—There are many cases of yellow fever in which treatment can be of no avail. The patient has received his death blow at the beginning. There are others, again, so mild that they get well spontaneously, under any kind of management, unless positively destructive. Hence the great uncertainty, in relation to the influence of remedies in this complaint. Under every kind of treatment, there are many deaths and many recoveries; and it is very difficult to determine how far the treatment has had any influence upon either result. The difficulty is increased by the circumstance, that, in different epidemics, and at different periods or in different localities of the same epidemic, there is great difference in the violence of the disease; so that a plan of treatment which is at one time apparently very successful, may be very unsuccessful at another. But there are many cases of intermediate grades of violence, in which the chances may be nearly equal between life and death, and in which appropriate measures may incline the balance favourably. Treatment, therefore, may be very important in yellow fever. It may rescue the intermediate cases, and often perhaps prevent the mild from assuming a dangerous form. In the conflict of sentiment between the different therapeutical plans, the judicious physician will select that which best accords with his pathological views; and, at all events, will shun hazardous measures unless very clearly indicated. The following method is that which has appeared to me most appropriate.

Very early in the disease, while there is yet no great gastric irritability, and no tenderness of the epigastrium, it may be proper to give an emetic of ipecacuanha, in cases in which there may be reason to suspect a loaded state of the stomach. The slight and temporary irritation of the emetic will be much less than that occasioned by the continued presence of undigested food or acrid secretions. But it must be remembered that the remedy is applicable only to the earliest stage, and under the circumstances mentioned. Should there be, at this stage, frequent attempts to vomit, with the discharge of only a little acrid matter, it would be proper to favour the efforts of the stomach by the administration of warm water or warm chamomile tea.

The question must be decided, at an early period, whether it will be requisite to use the lancet. On all hands it is admitted that, to be efficient, this must not be postponed; and it is generally considered a hazardous remedy after the lapse of one or two days. Bleeding will not cure the disease; nor should it be employed vaguely with this view. The only legitimate indication for the use of it is to diminish the danger of disorganization from the violence of inflammatory excitement. If carried too far, it may do immense harm by increasing the prostration of the second stage. It should be resorted to only when the pulse is tense and strong. When this is very frequent, or readily compressible, the lancet should not be employed. The enormous bleedings which have been recommended by some practitioners are, in my opinion, too hazardous to be justifiable in any case. Not more blood should be taken than may be necessary to reduce the force of the pulse; and this seldom exceeds fifteen, twenty, or at most thirty ounces in a vigorous adult. Less than the lowest quantity mentioned will often be sufficient. In the great majority of cases it will not be necessary to bleed at all.

A mercurial cathartic is almost always indicated. The constipation of the bowels, and hebetude of the liver call for this remedy. From ten to twenty grains of calomel should be given without delay, and followed in the course of a few hours by the sulphate of magnesia, or other saline cathartic. In some instances, where it may happen to accord better with the stomach and taste of the patient, castor oil may be substituted. Should the constipation be obstinate, recourse may be had to the infusion of senna in connexion with Epsom, Glauber's, or Rochelle salt, or to croton oil. The last has been strongly recommended in the dose of two drops. Should the stomach be too irritable to retain any of these cathartics, purgative enemata should be substituted, while the calomel is repeated, in such doses, and at such intervals, as circumstances may seem to require. After the bowels have been thoroughly evacuated, they should be kept open, during the remainder of the complaint, by moderate doses of the saline cathartics, magnesia, the Seidlitz powders, or enemata. Rhubarb and magnesia are adapted to the advanced stages; the former being indicated by its tonic, the latter by its antacid property.

It will be necessary that the practitioner should decide, at a very early period, whether he will have recourse to mercury in the treatment of this disease. So far as danger in yellow fever may depend upon inflammation, the mercurial impression upon the system, as being one of the most efficient antiphlogistic means, is strongly indicated. Experience, too, would seem to pronounce in its favour; for it is admitted, on all hands, that patients almost always recover, if salivation can be effected in the early stage. But it is often difficult, and indeed quite impossible to bring about this result. Mercury seems incapable of taking hold of the more violent cases, however energetically it may be employed. Besides, in many cases, the progress of the disease is so rapid that there is not time for the remedy to act, before fatal symptoms appear. Hence, many practitioners exclude mercury from their plans of treatment. They assert that it will not act in fatal cases, and that those in which salivation can be effected would get well without it. But this reasoning does not seem to me to be sound. It cannot be known, certainly, that the instances in which salivation occurs would end in recovery, under other measures. The circumstance, that, when the influence of mercury is experienced, the patient gets well, proves, at least, that the remedy can do no great harm. If, therefore, it is indicated upon general therapeutical principles, if it is not injurious, and if its influence when experienced is always followed by favourable results, whether as mere consequences, or as effects, there can be no impropriety, and, as appears to me, there is a strong propriety in employing it. But there must be no delay. The plan must be commenced immediately, and persevered in to the end. In this rapid disease, the rule which is applicable to chronic cases, of suspending the remedy for a time when the gums are touched, must not be obeyed. Relaxation, under such circumstances, would be often to let the enemy escape in the moment of probable victory. The mercury should be persevered in until the symptoms of the disease show a decided abatement. The best means of obtaining the impression is, after the administration of the purgative dose of calomel as above mentioned, to give a pill of two grains every hour or two without interruption, until the effect is produced. In very urgent cases, the quantity may be increased; in very mild ones diminished. Small doses, frequently repeated, are more efficient towards affecting the system than the same quantity in larger doses, and at longer intervals. Calomel is usually well borne by the stomach. It may even compose irritation of that organ. Should it too much disturb the bowels, it may be combined with opium. Recourse may be had also, if necessary, to mercurial frictions and mercurial dressings to blistered surfaces, at the commencement of the second stage. It will be necessary to be more cautious with the use of mercury in infantile cases.

But, whether the mercurial plan be adopted or not, it will be proper to employ febrifuge remedies during the existence of the fever. Nothing is more effectual in diminishing the heat, and composing the restlessness of this stage, than the external application of cold water. This application may be made by sponging the patient over the whole body, or by affusion. The latter mode is most effectual, and may be employed in the cases of robust individuals, not too far advanced in life. The patient being seated naked over a proper recipient, cold water should be poured upon him until the skin becomes cool, and the frequency of the pulse abates, or until he begins to feel slightly chilly, when he should be wiped dry and placed in bed. The application may be repeated, when the heat, dryness of skin, and restlessness return. It is scarcely necessary to caution the practitioner against employing this measure, in any case in which the skin is not universally heated, and quite destitute of moisture. Where the constitution is feeble, and the grade of excitement lower, sponging with warm water, or the use of the warm bath would be preferable. Should the state of the system be positively asthenic, spirit may be substituted for water as a lotion, and the hot vapour bath, for the warm or cold bath.

Internally, the refrigerant diaphoretics should be employed in this stage. Of these none is so exactly suited to the case as the effervescing draught (see *U. S. Dispensatory*), which, besides its diaphoretic operation, has the effect of frequently composing the excessive irritability of stomach. A dose of it may be given every hour or two, during the height of the fever. Nitre and the antimonials are less appropriate, because more apt to produce gastric irritation. When the pulse is very frequent and rather feeble, the Dover's powder may often be used advantageously, if not contraindicated by cerebral disease. In similar cases, infusion of serpentaria and spirit of nitric ether are appropriate remedies. The patient may be allowed to drink cold water frequently and in small quantities, or to chew and swallow small pieces of ice, which is usually very grateful, by allaying the burning heat of the stomach. Care must be taken, however, not to allow so large a quantity of ice to enter the stomach undissolved, as to endanger material depression. Iced carbonic acid water, in small draughts of about a wineglassful, is also very grateful, and useful in allaying gastric irritation.

Attention must be paid to the head and the stomach. For the pain of the former, leeches or cups may be applied to the temples or nape of the neck; the hair should be thinned or cut off; towels wet with cold water, or bladders filled with pounded ice, should be placed in contact with the scalp; and, occasionally, when the heat is great, and the pain severe, cold water may be poured from a moderate height upon the head, held over a basin. At the same time, hot and stimulating pediluvia may be employed as revulsives. For the irritability of the stomach, the best remedies are those already mentioned; viz., the effervescing draught, cold carbonic acid water, or small portions of ice. Small doses of one of the salts of morphia are sometimes useful, in connexion with the draught, or with other medicines. When pressure over the stomach occasions much pain, leeches may be applied to the epigastrium, followed by warm fomentations or emollient cataplasms, unless the weight of these should render them too uncomfortable to the patient. Sinapisms are sometimes useful in the early stage.

When the fever begins to decline, and the second stage commences, febrifuge and depleting remedies must be abandoned, and, unless symptoms of convalescence are obvious, without suspending the mercurial treatment, measures should be employed for counteracting the inflammation of stomach, and supporting the strength of the patient. For the former purpose, I know nothing better than the acetate of lead, as recommended by the late Dr. Irvine, of Charleston, S. C. (*Eclectic Repertory*, x. 519.) This remedy is not appropriate to the febrile stage, nor was it employed in that stage by Dr. Irvine. The period for beginning with its use is when the heat of skin and frequency of pulse abate; while a yellow hue begins to show itself in the conjunctiva or face, and tenderness in the epigastrium indicates continued or increasing inflammation of the stomach. One or two grains should be given every hour or two, and the remedy continued until from thirty to forty grains have been taken. I have employed it in some bad cases, with the happiest results. In one of them, the matter ejected from the stomach had begun to assume the flaky character of black vomit; and yet the patient recovered. I confess, however, that my experience with it has not been sufficiently ample to justify a positive recommendation, upon that ground alone. We employ the remedy, with great advantage, as a local application to mucous inflammation, as in that of the rectum and urethra, when not attended with high vascular excitement; and this is the exact condition presented by the gastric mucous membrane, in the second stage of yellow fever. Besides, the astringent properties of the preparation may render it useful in preventing the black vomit, which is now admitted to be a sort of hemorrhage.

But the case should not be trusted to this remedy alone. The epigastrium should be covered by a large blister, and the same application may be made to the extremities, in order to support the system, and to direct excitement to the surface. Powdered acetate of morphia sprinkled upon the blistered surface, over the pit of the stomach, will sometimes be useful in allaying gastric irritability. The strength must be sustained by mild nutriment. The farinaceous drinks and weak animal broths, or a little milk and water, may be employed for this purpose. Advantage may sometimes accrue from the use of lime-water and milk, in the quantity of a tablespoonful of each every hour.

Should the system show signs of sinking, it will be necessary to employ tonics and stimulants, with a nutritious diet. Sulphate of quinia or the compound infusion of Peruvian bark, the mineral acids, capsicum, oil of turpentine, wine-whey, carbonate of ammonia, wine, brandy, egg-nog, milk-punch, strong animal broths or essences, are the chief means to be used; and from these selections and combinations must be made in accordance with the degree of prostration. None of them are specific. All that they can do is to support the strength of the system, until the disease shall spontaneously terminate. It is possible that the capsicum and oil of turpentine may be useful as alteratives to the mucous membrane of the stomach. Should any one of these remedies occasion burning pain in the epigastrium, it must be omitted. Opium should be freely used, and may be combined with any one of them. The oil of turpentine with laudanum, or one of the salts of morphia, is a combination sometimes especially useful. Of the oil from twenty drops to half a fluidrachm may be given at once, suspended in water by means of gum arabic, and repeated every hour. Stimulating frictions should also be used in very prostrate cases. Should hemorrhage from the stomach or bowels occur, it may be met with acetate of lead, nitrate of silver, kino, and pure tannic acid, severally or in combination; and opium should be added to whichever of these remedies may be employed.

In the secondary fever, the treatment must be conducted upon general principles applicable to all febrile diseases; reference being always had to the strength of the system.

In cases of a low form at the beginning, where reaction is deficient or altogether wanting, it will be necessary to use the means which are recommended in the last stages of ordinary cases. External stimulation by means of the hot bath and powerful rubefacients, tonics and stimulants by the stomach, and stimulating enemata of oil of turpentine, brandy, laudanum, &c., must be employed. I should generally prefer for internal use, in such cases, the oil of turpentine and sulphate of quinia. The latter remedy may be given in large doses, as much even as from five to ten grains every two or three hours, until some effect may appear to have been produced. Cases of this kind, however, too frequently bid defiance to medicine.

In New Orleans, the practice of giving large doses of quinia, very early in the disease, is asserted by some to have been attended with great success. According to Dr. Fenner, it was first introduced in the epidemic of 1841 by assistant surgeon Charles McCormick and Dr. A. J. Wedderburn; and has been since extensively employed. From fifteen to thirty grains of sulphate of quinia are given at once, sometimes uncombined, sometimes in connexion with opium or a mercurial cathartic or both, and with various accessory treatment, according to the particular views of the practitioner. Sometimes the quinia is repeated, in the same or smaller doses. The febrile action is said to subside very speedily, and the patient frequently to enter almost immediately into convalescence; but, in other instances, though the primary fever may be apparently cut short, and the secondary fever prevented, yet the disease marches steadily onward to black vomit and a fatal issue, as in violent cases treated in the ordinary mode. (*N. O. Med. & Surg. Journ.*, v. 208.) In the comparatively mild epidemic of 1847, the quinia practice was found so satisfactory as to have been very extensively adopted in New Orleans; but in the very severe one of 1853 it was less successful; and the late Dr. Hester, editor of the *N. O. Med. & Surg. Journ.*, stated in the last number of that journal put forth under his supervision (vol. x. p. 404), that it had not proved satisfactory to those who employed it in the latter epidemic. In the preceding number (x. 279), he made the following statement. "In the commencement of the present epidemic, the advocates of large doses of quinia soon found that this article when given in sedative doses, failed to accomplish a cure, although the febrile symptoms gradually gave way to its use."

Dr. H. R. Frost, of Charleston, S. C., has found the chlorate of potassa an excellent remedy in the febrile stage of the disease. After having freely evacuated the bowels, he gives the chlorate in the quantity of three or four drachms in divided doses during the twenty-four hours, employing at the the same time, when necessary, leeches to the temples, and iced-water to the head. (*Charleston Med. Journ. and Rev.*, viii. 182.)

Throughout the treatment, especial attention should be paid to the thorough ventilation of the apartment, and to the preservation of personal cleanliness by a frequent change of linen, and of the bedclothes. All excrementitious matter should be immediately removed.

It is proper to state, before leaving the subject of the treatment of yellow fever, that some practitioners, especially in the French West Indies, have been in the habit of relying upon the mildest measures; trusting rather to the resources of the system, aided by the removal of noxious influences, than to any strong remedial impressions. In the first stage, demulcent beverages, chicken water with a little nitre, or other weak ptisans, perhaps a small bleeding when the excitement is great, a little magnesia now and then, fomentations or poultices to the abdomen, or a few leeches to the epigastrium, and the warm bath; in the latter stages, preparations of bark, mineral acids, camphor injections, &c., constitute the routine of the treatment; and it has been asserted that the success of the plan is little if at all short of that of the more energetic methods usually employed.

The prevention of the disease is even more important than its treatment. In relation to individuals, when circumstances prevent their leaving the place in which the disease prevails, they should select a residence in the highest and healthiest spots; should sleep preferably in the highest part of the house; should avoid the night air; should abstain from fatiguing exercise, exposure to alternations of temperature, and excesses of all kinds; should endeavour to maintain a cheerful and confident temper; should use a nutritious and wholesome but not stimulating diet; and, if compelled to enter any spot in which the atmosphere is known to be infected, should take care not to do so when the stomach is empty, or the body exhausted by perspiration or fatigue. Attempts to guard against the disease by low diet, bleeding and purging, or the use of mercury, are futile, and even worse than futile. The feebler the system, the less is it able to resist the entrance of the poison, or its influence when absorbed.

The public also have important duties in this complaint. Letting alone the vexed question of quarantine, we may insist on the necessity of establishing hospitals in healthy situations, of removing as far as possible all sources of noxious effluvia, of correcting such effluvia where known to exist by fumigations with chlorine, and finally, in our northern cities, where the limits of the infected neighbourhoods are often well defined, of removing the inhabitants from within these limits, and excluding the entrance of others by the temporary erection of fences across the streets or avenues. In places where the residents have become exempt from the disease by habitual exposure to the cause, it will be sufficient to remove and exclude strangers and children from the infected districts.

Article IV.

ENTERIC FEVER.

Syn.—Typhoid Fever.—Typhus mitior.—Nervous Fever.—Abdominal Typhus.—Common Continued Fever.—Entero-mesenteric Fever.—Dothinenteritis.—Follicular Enteritis.

This is a common febrile affection, presenting a considerable diversity of symptoms, yet having in general a certain recognizable character, and probably constituting, in all its forms, one and the same disease. It is the ordinary endemic fever of Europe, and of those portions of the United States in which the miasmatic or bilious fevers do not prevail, and is more or less mingled with the latter within their own special limits. Indeed, the probability is that it belongs to the whole human family, and is to be found in all inhabited regions. Though long known in its different forms, its identity in these forms was not clearly perceived until after the researches of Louis, which, by determining its anatomical, in connexion with its exterior character, gave us the means of recognizing it under every variety of aspect.

The nomenclature of this disease is unsettled and perplexing. By some writers it is denominated *continued* or *common continued fever;* but this term is not sufficiently distinctive; as other fevers, equally common in many situations, are equally continued; and, in fact, English authors generally confound under the title two affections, which are probably quite distinct; namely, the disease under consideration and proper typhus fever. The name of *typhoid fever*, applied to the disease by Louis, and now much in use, is, I think, still more unfortunate. Independently of the fact, that the complaint is not essentially typhoid, and that it very often runs its whole course without any symptom analogous to those which characterize typhus fever, there is the strong objection, that any other febrile affection may equally assume the typhoid form; so that a mere epithet, applicable to a common condition of disease, is thus appropriated to a distinct complaint, and must inevitably lead to frequent misconceptions. Bilious fever, yellow fever, the plague, the different exanthematous fevers, and all the phlegmasiæ may become typhoid, as well, though not, it is true, as frequently as the one in question. It is highly desirable, therefore, that the name should be abandoned, though there is reason to apprehend that it has already taken root too deeply to be easily eradicated. There can be no doubt that the affection, denominated *typhus mitior* by the older writers, was very often that which we are now considering; but the name is objectionable, as implying only a difference in degree between this and true malignant typhus. *Nervous fever* is less inappropriate than either of the preceding titles; as the disease is pre-eminently marked by nervous disorder, and the cases to which the name has been applied have probably in general belonged to it. But almost all fevers, indeed we may say without qualification, all fevers are attended with some degree of nervous disorder; for this enters into the very definition of the term fever; and the title, therefore, is not sufficiently distinctive. *Dothinenteritis* (from δοθιην, pustule, and ἔντερον, intestine) was a name conferred on the complaint by Bretonneau, and was intended to express the eruptive character of the intestinal affection which distinguishes it. *Follicular enteritis* had the same origin. Both are objectionable upon the score, that they consider as essentially the disease what is a mere attendant, though a very common one. I propose the title of *Enteric fever* with some diffidence. It has the same basis as the *Entero-mesenteric fever* of M. Petit, but has the advantage over it of greater simplicity. It is merely intended to express the fact, that this fever is distinguished from all other idiopathic fevers by the frequency and extent of intestinal disease. Other fevers are attended occasionally with disease of the bowels; this almost always, if not essentially. The intestinal affection is as characteristic of this disease as the eruption is of smallpox.

Symptoms, Course, &c.—The disease sometimes begins abruptly by a chill, followed by the usual symptoms of fever; but, as it occurs in this country, it more frequently comes on insidiously, and increases gradually, so that it is often impossible to fix the precise point of commencement. The patient is uncomfortable, and complains, perhaps, of weariness, general uneasiness, soreness or numbness of the limbs, and often of a little headache; the skin is somewhat heated, the face flushed, and the pulse accelerated; the tongue, if examined, is found to be very slightly coated with a thin whitish fur; the appetite is impaired though not quite extinguished; and these symptoms continue, with a slowly increasing intensity, but with a tendency to daily remission, for several days, sometimes even for a week, before the patient feels himself sufficiently ill to take to his bed. Frequently, during this period, slight chilliness alternates with febrile sensations; though it sometimes happens that the patient complains of no chill whatever, and distinct rigors or shivering are rare. When the disease is completely formed, the chilliness ceases, and does not return, unless, perhaps, at the commencement of some incidental inflammation. There is also not unfrequently, during this inchoative stage, some looseness of bowels, amounting often to diarrhœa; and, when this is not the case, there is generally an extraordinary susceptibility to the action of cathartic medicine, which operates in much smaller doses than usual, or, if given in the full dose, produces more than the usual effect.

The disease, being now fairly under way, exhibits the ordinary phenomena of fever; such as frequency of pulse, heat and dryness of skin, flushed face, pains in the head, complete loss of appetite, thirst, and great general weakness. But the symptoms are also somewhat peculiar. The pulse, though sometimes but moderately accelerated, not exceeding 90 or 100 in the minute, and of considerable fulness and strength, is in other instances, and especially in females, very frequent, small, and compressible, often amounting to from 110 to 120 or more. The flush in the face is of a somewhat more purple tint than in most other cases of fever; and, when it is absent, there is not unfrequently a dusky hue of the complexion, with a certain heaviness or dulness of expression, which may be very slight in some cases, but is very striking in others. Headache, in some degree, is very seldom absent; and not unfrequently it is the chief subject of complaint. The patient also often experiences pains in the back or limbs, and sometimes has a feeling of universal soreness, as if bruised, or greatly fatigued. Sometimes there is much restlessness, with want of sleep. A characteristic symptom is, in many instances, the occurrence of bleeding at the nose, which, however, is generally slight, and no otherwise important than as a sign. In very many cases, a tendency is observed in the febrile symptoms to remission, sometimes daily, sometimes twice a day; and occasionally the exacerbations subside with slight perspiration; though this is much less frequent and more sparing in enteric, than in bilious or miasmatic fevers.

These symptoms continue with little other change than a gradual increase, for several days. The pulse becomes more frequent and less strong; the skin acquires a heat and aridity which are often described as acrid or pungent; the obtuseness of countenance and duskiness of complexion deepen; the tongue remains slightly covered, or coats itself with a thicker fur, in either case showing a tendency to dryness or clamminess, and often appearing red at the tip and borders; the stomach, though often retentive, is sometimes irritable; diarrhœa is not unfrequent; transient pains are often felt in the abdomen, increased by pressure, especially in the right iliac region; and a slight degree of tympanitic distension in the bowels is discovered upon percussion, with a gurgling sound upon pressure by the hand. A cough frequently sets in, either dry, or accompanied with a slight mucous expectoration; and the physical signs of bronchitis are detected by the stethoscope. The urine is sometimes little changed, sometimes scanty, high-coloured, and offensive. Such is the course of the disease, until about the seventh or ninth day from the time of complete formation.

Other symptoms are now superadded. The tongue, previously moist or clammy, often becomes quite dry, and assumes a brownish colour. Deglutition is sometimes painful or difficult. The abdomen is obviously distended, so as frequently to present a convex outline from the ensiform cartilage to the pubes, when the patient is on his back, and upon percussion, sounds hollow or tympanitic. If the surface be carefully examined, red spots like flea-bites will show themselves, usually appearing at first in small numbers upon the abdomen, but afterwards increasing, and sometimes extending to the chest, and even to the limbs and face. At the same time, a close inspection will often detect an eruption of small vesicles, called sudamina, upon the neck and upper part of the chest, and occasionally also on other parts of the body. The nervous symptoms become more decided. Delirium or stupor often takes the place of the headache with which the patient had been tormented. Ringing or buzzing in the ears is followed by hardness of hearing, amounting sometimes to deafness. The eyes are often injected. The tongue is protruded with difficulty, and is occasionally observed to tremble in the effort.

If the disease continue, a completely typhous condition is at length developed. The tongue is often incrusted with a brown or black coating, or is dry, gashed, and sore; while dark sordes collect upon the teeth, gums, and lips. The pulse becomes exceedingly frequent and feeble. The surface is either universally hot and dry, or hot in some parts while it is cool in others; and a peculiar unpleasant odour often exhales from the body; subsultus tendinum, twitching of the facial muscles, and even epileptiform spasms sometimes make their appearance. The patient is very feeble, lying on his back, and often slipping involuntarily down in the bed. He picks at the bedclothes, or at imaginary objects in the air; mutters half-formed, delirious sentences, or exhibits a profound coma; and sometimes, under the influence of a potent delirium, attempts to rise from his bed, and, unless guarded, reaches the door of his chamber, and perhaps falls exhausted. Other occasional symptoms are involuntary fecal evacuations, retention of urine, hemorrhage from the bowels or nostrils, and petechiæ and vibices upon the skin. Vitality is so feeble in the skin, that blistered surfaces often slough, and gangrenous eschars are produced in parts exposed to continued pressure, as over the sacrum, or upon the hips.

Finally, if the case is to end unfavourably, the pulse gives way, and becomes either excessively frequent and fluttering, or slow and scarcely perceptible; the extremities become cool and clammy, or the whole surface is bathed in a clammy sweat; the abdomen is often enormously distended; hiccough sometimes occurs; the countenance assumes the hippocratic aspect; and life is quietly and almost insensibly extinguished. Sometimes, however, when the fatal issue takes place at an earlier period, death is preceded by apparently painful struggles or convulsions.

When a favourable termination is to take place, the tongue becomes moist, and begins to clean itself gradually at the tip and edges; the pulse lessens in frequency and acquires greater fulness; the skin relaxes, becoming cooler and less dry; the stupor or delirium subsides; the patient pays more attention to things around him, and exhibits more solicitude for himself; the abdominal distension diminishes, and some inclination for food returns, or at least less aversion for it is displayed. Convalescence, under these circumstances, speedily takes place; and not unfrequently the emaciation becomes more evident at this moment than it was before.

In other instances, especially in severe and more protracted cases, the course is somewhat different. Instead of cleaning gradually from the edges, the tongue throws off its fur in flakes, generally at first from the centre or towards the base, leaving the surface smooth, red, and somewhat shining, as if the papillary structure had been partially destroyed. This state of the tongue is sometimes preceded by soreness of the fauces; and the velum pendulum and half arches will, if examined, be found covered with an exudation, which they are beginning to part with. This is usually a sign of an approaching amelioration of the symptoms. If the tongue, when thus cleaned, remain moist, convalescence may be pretty confidently expected, though it is always tedious. In some instances, the tongue coats itself over again, and again becomes clean; and this change may take place more than once. Occasionally, too, a thrush-like exudation appears upon its surface. But still, if the moisture continue, the prognosis is ultimately favourable.

If, however, at any time during the above cleaning process, or even after it has been completed, the tongue should become permanently dry, the symptoms are again aggravated, and the patient again thrown into danger. I have ascribed this result to an increase of the intestinal disease, which is a prominent feature in the complaint, and have found it to yield most happily to treatment addressed to that affection.

But, as before observed, the convalescence after this mode of cleaning of the tongue is always somewhat tedious, and often very much so. It implies a degree of mischief to the organization which time only can repair. Sometimes months elapse before the patient recovers his usual health. The pulse remains long frequent, a febrile paroxysm somewhat resembling hectic occasionally appears every day, there are copious and debilitating sweats at night, the appetite is feeble, and the bowels are disturbed by slight causes. Troublesome nervous symptoms also frequently occur; such as wakefulness, depression of spirits, weakened memory, childish fretfulness, and sometimes a kind of imperfect delirium or insanity, though this is rare. The lower extremities sometimes become painful and edematous. Troublesome and tedious abscesses occasionally break out, especially near the parotid; and boils appear in various parts of the body. At length, these symptoms gradually disappear, the appetite returns, and even becomes insatiable, and the patient rapidly acquires strength and flesh. Not unfrequently, the premature or excessive indulgence of the appetite causes disagreeable intestinal symptoms; and I have known it apparently to be the cause of a fatal relapse. The patient generally loses his hair, which, however, grows again; and the cuticle of the palms of the hands and soles of the feet is apt to desquamate.

There is occasionally a fatal termination of this disease, of a peculiar character, which it is necessary to notice. The patient is suddenly seized, without any premonition of danger, perhaps even in the midst of convalescence, with violent pains in the abdomen, which is also exceedingly tender to the touch. Sometimes there is no pain; but only tenderness. The knees are drawn up, and the face assumes an anxious and even ghastly expression. Rigors, an exceedingly frequent and contracted pulse, obstinate vomiting, and constipation, are also frequent symptoms. A collapse of the circulation and of the surface precedes death, which takes place usually within a day or two, though life is sometimes prolonged for a week. The cause of these symptoms is a perforation of the intestine, and the escape of its liquid contents, producing inflammation of the peritoneum. It is more frequently the mild than the aggravated cases of the disease, that are liable to this serious accident. It occurs at variable periods in the progress of the complaint, having been noticed as early as the twelfth day, and as late as the fortieth.

The duration of this disease is uncertain, but usually protracted. Death may take place on the sixth or seventh day; but so early a termination is very rare. Generally it occurs in the course of the second or third week, and sometimes not till the end of six weeks, or even later. The period of convalescence is equally variable. It sometimes begins on the eighth or ninth day, but very rarely before the third week. Even the mildest cases run on to the fourteenth or fifteenth day; those of a severer character seldom become convalescent before the end of the third or fourth week; and not unfrequently we witness recoveries even after the sixth week. The average duration of cases may be stated at from twenty to thirty days. The disease seldom lasts longer than sixty days, though it has no fixed limits.

Certain symptoms which occur in the course of the disease are so important, in reference to diagnosis or prognosis, as to require separate consideration.

Diarrhœa, according to Louis, is an almost uniform symptom, having been absent in only three of the cases examined by him. It must be remembered, however, that the occurrence of liquid stools constitutes diarrhœa in the estimation of that author, though there may be only one daily. But even with this limitation, the observation is not applicable to the disease as it occurs in this country; at least as it has occurred within my own observation. Diarrhœa is undoubtedly frequent, so much so, indeed, that it may be considered among the diagnostic symptoms; but it is also not unfrequently wanting. I have noticed, however, that, even when there is apparent constipation, the bowels are acted on by purgative medicine much more readily and abundantly than in most other febrile diseases. So much is this the fact, that in a doubtful case of fever, an unusual or extraordinary effect from purgative medicine should have some weight in influencing the decision as to the nature of the disease. The diarrhœa sometimes precedes the fever; but more frequently commences during the first twenty-four hours after the attack, and is occasionally postponed to a much later period. The stools may be only one or two daily, or more frequent, up to ten, twelve, or more. They are generally yellowish or brownish, and apparently healthy except in consistence. This is one of the remarkable features of the disease. While in other severe fevers the discharges are almost always greatly altered, in this, they often remain nearly natural with the exception alluded to, throughout the complaint. Sometimes, however, they are black or bloody, especially in the advanced stages; and, in a relatively small number of cases, they are dysenteric. The diarrhœa undoubtedly depends upon the inflammation or irritation of the mucous membrane; but has not been found to bear any fixed relation to the characteristic disease of the aggregated intestinal glands. It is generally attended with *pains in the abdomen*, which, though not usually very severe, are often troublesome. When wanting, they may sometimes be elicited by pressure. They may be present also when there is no diarrhœa.

Tympanites, in a greater or less degree, is an almost constant attendant of enteric fever. I have very seldom witnessed a case without some degree of it. It does not begin with the disease; coming on usually about the seventh day, though sometimes as early as the third. At first it is not very obvious. There may be a slight increase of tension in the abdominal parietes; but percussion is necessary to the certain detection of the symptom. It increases as the disease advances, and soon becomes obvious to the eye. In general it bears some proportion to the severity of the disease, being moderate in mild cases, and greater in the severe. Sometimes it is very great, causing an enormous distension of the abdomen, so as to interfere with respiration by pressure upon the diaphragm. Under these circumstances, it occasions great distress to the patient. It is also injurious by distending the bowels, so that they cannot act on their contents. This morbid collection of air is chiefly in the colon; the small intestines being comparatively little affected.

The *rose-coloured eruption* is one of the most characteristic phenomena of enteric fever. This consists of small red spots, usually roundish, and about a line in diameter, though sometimes larger, often slightly prominent, and disappearing under pressure with the finger, to return upon the removal of the pressure. They are never seen at the commencement of the disease, but generally first make their appearance between the seventh and fifteenth days, and occasionally later. They occur in general first and most numerously on the abdomen, extending afterwards to the breast, and occasionally also to the extremities, and even to the back and face, though very rare in the last mentioned position. I have seen them abundant on the upper and inner part of the thighs, and confined to that place. Their number varies greatly, sometimes not exceeding two or three, sometimes being almost countless. They appear in successive crops, each lasting three or four days, and then gradually fading; and the whole period of the eruption varies, according to Louis, from three to fifteen days. Though present in the great majority of cases, at some period in the progress of the disease, they are not so in all. Out of seventy cases referred to by Chomel and Genest, they were absent in sixteen, or about one-quarter. As the disease has occurred to my own observation, they are very seldom absent; and I have no doubt that, from their small number, faintness, and fugitive character in many cases, they are often only overlooked where they are supposed to be wanting.

These spots must not be confounded with petechiæ, which also appear in this disease, but are not peculiar to it. The latter can scarcely be considered strictly as an eruption; consisting merely of blood extravasated in the skin. They are distinguishable usually by their more livid colour, by never projecting above the surface, and by not disappearing upon pressure. They occur much less frequently than the rose-coloured eruption, and are more common in genuine typhus fever than in the enteric. Sometimes the hemorrhagic effusion is more extensive, consisting of patches or vibices.

Sudamina are minute vesicles, generally about the size of a small pin's head, but sometimes larger, either circular or oval, and, in consequence of their minuteness and transparency, often requiring to be viewed obliquely in order to be seen. They may frequently be detected by the touch. They occur usually on the neck and upper part of the chest, especially towards the shoulders, or near the axilla or groin; but may sometimes be seen upon the trunk and limbs; and I have known them to cover thickly almost the whole body, except the face. The period of their eruption is generally later than that of the red spots, being rarely earlier than the fourteenth day. They are also less constant, and less characteristic, occurring in other febrile affections as well as in that under consideration.

Cough and the *bronchial rales* are very common in this complaint. The cough is either dry, or attended with a slight mucous expectoration, with very little or no soreness or sense of oppression in the chest. The dry sonorous and sibilant rales may be heard more or less extensively over the thorax, and are much greater in proportion to the amount of oppression or dyspnœa than in ordinary catarrhal affections. They thus afford an important diagnostic sign. They are not, however, present in all cases. Sometimes they begin with the disease; but more frequently not until the lapse of about a week. Occasionally, they give place to a crepitant or sub-crepitant rale, indicating the occurrence of inflammation in the parenchyma of the lungs.

The *pulse* is generally frequent, sometimes in the early stages full and strong, sometimes even from the commencement rather feeble, and almost always becoming so as the disease advances. It is, however, very different in different cases. I have known it not more frequent than in health, and differing from the natural state only by its weakness. This, however, is exceedingly rare. A moderate degree of acceleration, with some fulness and strength, is not uncommon in mild cases, and in the early stages of those which are more severe. But if there be any one condition of pulse more characteristic than another, it is that of frequency, smallness, and want of strength. Such is often its condition at the outset; and, when this is not the case, there is a very general tendency to it in the progress of the disease. The number of pulsations is often at first from 110 to 120, and sometimes increases to 130, 140, and even to 160, before the close. In the last stage, the pulse, along with its frequency and feebleness, is occasionally irregular and intermittent; and Louis has found this condition, in most cases, associated with softening of the heart. Instead of increasing in frequency in the prostrate state of system, it sometimes becomes even slower than in health, and exceedingly feeble, indicating an absence of irritating influences, or an extraordinary insensibility to their action. In the former case, this condition of the pulse is favourable, in the latter it may be otherwise.

Hemorrhage is not an unfrequent symptom of enteric fever. In the early stage, it takes place from the nostrils, and is highly characteristic. The epistaxis is usually very moderate, often not exceeding a few drops, and very seldom in any degree alarming. In some rare cases, however, it is more copious, especially at a late period, and demands the interference of remedies. But, in relation to its effects, *hemorrhage from the bowels*, which occasionally takes place in the advanced stages, is much more important. This is often, at the same time, a bad sign, and injurious by the exhaustion it produces. It requires the careful attention of the practitioner, and the stools should always be examined in reference to it. In some instances, the blood is red and but little changed, in others it is blackish and disintegrated. Occasionally bleeding takes place from other mucous surfaces; and petechiæ are nothing more than examples of an interstitial hemorrhage.

The *nervous symptoms* are peculiarly prominent in enteric fever. *Headache* has been already referred to as one of the most common and troublesome symptoms. It is seldom entirely wanting throughout the case. In general, it is heavy and dull rather than acute, most frequently occupying the forehead and eyes, though sometimes occurring in the back of the head, and sometimes affecting the whole head. The eyes are occasionally sore to the touch, or upon motion. Not unfrequently, also, pain is felt between the shoulders, and in the loins and extremities; but this generally soon ceases.

The headache usually continues for a week, after which it often gives way to stupor or delirium, and does not return when these are dissipated.

Dulness or *hebetude* of mind is one of the most common symptoms, often appearing early in the disease, and showing itself in the expression of countenance, which is apt to be blank, apathetic, or dejected. There is often an indisposition to be disturbed, and the patient answers questions reluctantly, or shortly, as if vexed. This heaviness usually increases as the disease proceeds, till it amounts to drowsiness, stupor, and even coma; but this is seldom so profound that the patient cannot be roused by speaking to him in a loud voice. The stupefaction does not yield the comfort of sleep; for the patient often complains, in the midst of it, of a want of rest. Instead of it, there is sometimes morbid vigilance, with great restlessness and jactitation.

Delirium often appears after several days, but usually not in any considerable degree until the seventh day or later. In general it is mild, indicating rather want of power in the brain than irritation. If the attention is strongly fixed, the mind often acts correctly; and it becomes wandering only when left to itself. This wandering is especially observable upon waking from sleep, and in the night. In some instances, however, the delirium is violent and even furious, so that the patient screams loudly, and requires force to restrain him. Occasionally it is fantastic, and somewhat hysterical, inducing the strangest and most whimsical notions, and corresponding actions. Thus, I have known a patient to have the idea that he was taking a walk, and to imitate with the arms and legs, while lying in bed, the motions of that kind of exercise. A not unfrequent notion is, that he is absent from home. In the last stages of the disease, the delirium is apt to become low and muttering; the patient lying with his eyes half-closed, and uttering, in a low or whispering voice, broken sentences, having only a vague connexion. Occasionally, however, even in this stage, it is violent; and the patient, unless restrained, will rise from his bed, and even leave his chamber. The stupor and delirium sometimes alternate, and are not unfrequently combined. The latter is usually later in appearing than the former.

Hardness of hearing is another highly characteristic symptom, which I have not observed so strikingly or frequently in any other febrile disease. Sometimes it is slight, sometimes so great as to amount almost to deafness. It does not usually occur in the first stage of the fever. It is not unfrequently preceded or accompanied with tinnitus aurium.

A *tendency to sloughing of the skin* is much more striking in the advanced than the early stages. It shows itself particularly when the surface has been inflamed, as by blisters or sinapisms, and when it is subjected to pressure and friction, as from the long continuance of the body in one position. Blisters are most apt to be followed by this effect, when applied furthest from the centre of circulation. The insensibility, more or less complete, which is so common in this disease, favours the production of eschars from pressure. The patient is not sensible of the mischief, and does not therefore change his position. The first effect is to produce a deep redness, which is followed by a separation of the cuticle, sloughing of the skin, and ultimately an ulcer, when the case is sufficiently protracted. The feeble capillary circulation, and diminished vitality of the surface, are the remote causes of the mischief.

One other symptom deserves particular notice. I allude to the *retention of urine*, which is not unfrequent in the advanced stage. In consequence of defective sensibility, urine accumulates in the bladder so as to produce considerable distension before the want of micturition is felt; and then the muscular coat of the bladder has been put so much upon the stretch as to have lost its power of contraction, and the accumulation goes on increasing. Enormous distension is thus sometimes induced, endangering inflammation or rupture of the coats of the bladder. When a certain degree of sensibility remains, great uneasiness is produced, which is in some cases referred to its proper position by the patient, but in others only occasions restlessness and moaning. In complete insensibility, no consciousness of inconvenience is evinced. The practitioner is liable to be led into error by the fact, that a slight involuntary stillicidium of urine is apt to take place in these cases, which is, however, insufficient to prevent continued accumulation. In all cases of enteric fever, the physician should be constantly on his guard against this accident in the latter stages. Though concealed from the eye by the coexistence of tympanites, the distension of the bladder may be usually detected at once by the dulness which it yields on percussion over the pubes.

M. Martin Solon has paid special attention to the state of the urine in this disease. He has found it to be more scanty, higher coloured, and denser than in health, equally acid if not more so, much more abundant in urea, and occasionally albuminous, especially in severe cases, in which this character of the secretion must be considered as an unfavourable sign. (*Archives Générales*, 4e sér., xv. 545.) Dr. J. W. Begbie, of Edinburgh, has found it frequently albuminous in the advanced stages, and has noticed that in the fatal cases this impregnation continues until death, while, in those which recover, it sometimes disappears when convalescence is completed, and sometimes persists for an indefinite period afterwards. (*Ed. Month. Journ. of Med. Sci.*, Oct. 1852, p. 384.) Mr. G. W. Edwards has found the urine in the early stages invariably destitute of albumen, but heavier than in health in consequence of the excess of urates. He thinks that albumen appears only when the crisis is past. (*Ibid.*, Sept. 1853, p. 236.)

Varieties and Complications.—Though the description above given is applicable to the great majority of cases, there are peculiarities in not a few which require notice.

In some instances, the disease presents no other symptoms than those of a moderate fever, with the characteristic phenomena of a slight diarrhœa or tendency towards it, some meteorism of the abdomen, and perhaps a few rose-coloured spots. The tongue remains soft, moist, and whitish throughout; there is no vomiting, no considerable nervous disorder, no great prostration, in fine, none of those peculiar symptoms usually denominated typhous. The disease runs its course in two or three weeks, sometimes even in less time, and then subsides spontaneously, leaving no unpleasant effects. Such cases are often mistaken for miasmatic remittent, especially as they not unfrequently have a daily remission and exacerbation of the febrile symptoms.

Occasionally we meet with cases in which diarrhœa is the prominent symptom; so much so as to lead to the conviction, upon a superficial examination, that the disease consists essentially of a chronic mucous inflammation of the bowels. There are increased frequency of pulse, a slightly furred tongue, and perhaps some restlessness, mental depression or disquietude, or other slight nervous symptom; but little or no headache or other sign of cerebral disorder, little heat of skin, no great prostration, and no typhous phenomena. The disease may thus run on for several weeks, exciting little solicitude, except by its obstinacy. I have been repeatedly called in consultation, in such cases, and have been able to detect their true nature by an examination of the abdomen, which is always somewhat tympanitic, and often exhibits the rose-coloured spots. If not arrested, the case at length assumes a more characteristic form. The tongue becomes dry, the skin arid, the pulse more frequent, and the abdomen prominently tympanitic; stupor or delirium sets in; and the other symptoms, already enumerated as marking the last stage, make their appearance in greater or less severity.

There is another class of cases, more rapid and violent in their character, in which the prominent symptoms are those of gastric or hepatic disorder, or of both. Along with the characteristic symptoms of enteric fever, we have much nausea and vomiting, often of bilious matter, tenderness of the epigastrium, and not unfrequently yellowness of the conjunctiva or the skin. These cases may be readily mistaken for bilious fever. They are apt to run their course rapidly, and sometimes terminate fatally before the rose-coloured eruption has appeared. I have seen a case of this kind in consultation, which was considered by a skilful and experienced physician as bilious fever, but which I suspected to be enteric fever from the state of the bowels, connected with a commencing meteorism, and the character of the cerebral symptoms. The patient died in about a week, and the glandular patches of Peyer were found enormously enlarged.

Sometimes the pectoral symptoms are most prominent. Instead of the ordinary dry or mucous cough and bronchial rales, with little or no oppression, we have a tenacious or bloody expectoration, shortness or difficulty of breathing, sometimes pain in the chest, and the physical signs of crepitation and dulness, indicating the supervention of pneumonia.

In other cases, the brain is especially involved. Delirium and stupor, one or both, and in various modifications, are the features which most attract attention. These may be connected with inflammation of the cerebral membranes, or strong sanguineous determination to the head; or they may be the consequence of deficient action in the brain, dependent either on a direct loss of power, or an altered state of the blood. When occurring in the earlier stages, without the signs of general prostration, they may be ascribed to the former cause; under contrary circumstances, though they may also sometimes depend upon positive excitement in the brain, it will, as a general rule, be safer to refer them to the latter. Now and then cases occur in which the cerebral symptoms are precisely those of meningitis, but in which after death no meningeal inflammation is detected, but much intestinal disease. The probability is that, in such cases, the cerebral disorder is caused by the irritation of the enteric affection transmitted to the nervous centres in the brain.

There is still another set of cases, in which the typhous element seems to predominate. From the beginning, there is an obvious deficiency of general power. The feeble, though perhaps frequent pulse, the obvious sensorial debility, the tendency to black sordes upon the tongue and teeth, the petechial and hemorrhagic disposition, the dark stools, the peculiar typhous odour, and the speedy and great prostration of strength, are evidences of this condition of system.

Frequently it happens that the varieties above alluded to are more or less combined in the same case; and a still greater diversity may arise from the occurrence of inflammation in parts not particularly mentioned, as in the kidneys or bladder, in the skin constituting erysipelas, in the joints imitating rheumatism, and in the spinal marrow giving rise to palsy. Lastly, there are occasionally cases, called *latent* by Louis, in which the characteristic symptoms are entirely wanting, and nothing calls attention to their true nature, until, perhaps, perforation of the bowels takes place, or death from some other cause reveals the existence of the peculiar intestinal affection.

Dr. J. H. T. Beau has described a species of acute paralysis, characterized by intense subsultus tendinum or muscular trembling, with difficult articulation, fever, and low delirium soon terminating in coma, which he has noticed as occurring during convalescence from enteric fever. The affection always ends fatally in a period varying from three to six days. The most constant of the lesions found after death is softening of the cortical substance of the brain, attended sometimes with cerebral congestion, and injection of the vessels of the pia-mater. The same affection sometimes occurs in the course of the fever, and has been noticed in the convalescence from other diseases, but never as an original affection. He proposes to call it *general acute palsy*. (*Archives Générales*, 4e sér., xxviii. 5.)

Anatomical Characters.—There is scarcely a single organ of the body, in which signs of inflammation are not sometimes found after death from enteric fever; for it is one of the peculiarities of this affection, or possibly of the febrile movement, which in this affection is of unusual duration, to develope local disease of an inflammatory nature. But there are certain anatomical changes which are especially characteristic of enteric fever, and which are so seldom wanting that they may be considered as almost essential. Such is the affection of the elliptical patches of those peculiar minute bodies in the ileum, denominated the glands of Peyer. This is quite as characteristic of the disease in question, as the peculiar pustular eruption is of smallpox. It has, in fact, come to be regarded almost as a necessary post-mortem test of the existence of the disease. The affection had been observed by various pathologists, as by Stark, Petit, and Bretonneau; but it is to Louis that the credit is especially due of fixing its precise relation to this form of fever. The facts ascertained by the last mentioned pathologist, in relation to the enteric fever of Europe, have been amply proved to be equally applicable to the disease, as it prevails in the United States.

The opportunity is seldom offered of ascertaining the condition of the *glands of Peyer* in the earliest period of the disease. They have been examined, however, at all stages after the sixth day. At first the patches are observed to be thickened, and their surface elevated one, two, or even three lines above that of the surrounding mucous membrane. The largest are from two to three inches long, and from half an inch to more than an inch broad; the longest diameter being in the direction of the intestine. Some are smaller and more circular. Their edges are in general clearly defined, smooth, and regular, but sometimes irregular and ragged. Some of them are dark red, some pale, and others of an intermediate hue. There are two varieties of them, distinguished by Louis by the names of *hard* and *soft*. The former are hard to the touch, and, when dissected, are found to contain, beneath the mucous membrane, and resting upon the muscular coat, a layer of white or yellowish, firm, brittle matter, the cut surface of which is smooth and shining. The latter are softer, less elevated, and destitute of the whitish layer above mentioned; their elevation, when at all observable, being caused by an inflammatory thickening of the mucous membrane covering the patches, and of the submucous cellular tissue. In these, the mucous surface appears at first granular or finely mammillated, with innumerable small orifices, which give it a reticulated appearance; a condition which is ascribed by Louis to an enlargement of the several follicles. This character is lost in the progress of the affection; the surface becoming uniform, smooth, and still softer. Sometimes the same elliptical patch exhibits both the forms just described, one in one part of it, the other in another; and often some of both varieties are found in the same case. The patches vary in number from one up to thirty, averaging perhaps ten or twelve. They appear upon the surface of the intestine opposite to the mesentery. They do not all originate at once, but in general come successively, those near the ileo-cæcal valve first appearing, and afterwards those higher up, even into the jejunum. The consequence of this successive appearance is a difference in the degree of their developement, the oldest being most advanced. Those highest in the intestine are sometimes but just visible, while the lowest are in a state of ulceration.

The hard patches may undergo resolution or ulceration; the soft always ulcerate. In the former, the matter deposited beneath the mucous membrane first softens, and separates from its connexions, so as to be thrown off when the mucous coat above it is removed. The surface is found in various stages of ulceration; but, when the process is completed, the whole patch constitutes one ulcer, which sometimes remains of the original size, sometimes spreads, and is occasionally stained yellow by the bile. In some instances, the floor of the ulcer is the muscular coat; in others, in consequence of the destruction of that tissue, it is the peritoneal coat; and this occasionally is found penetrated, so as to form a communication with the cavity of the peritoneum. Out of fifty-five cases which he examined, Louis found eight of perforation. Sometimes there was only one orifice, sometimes two or three. The opening was in the centre of the ulcerated patches, and always in the vicinity of the cæcum. The perforation is produced either by the progress of ulceration, by mortification of the uncovered peritoneal membrane, or by its rupture from force applied within the bowel.

The ulcers are not necessarily fatal. On the contrary, dissection has afforded abundant proof that they have a tendency to heal. In the process, the elevated border is depressed, the cavity is filled by granulations, and the surface is ultimately covered with a new mucous membrane, which, though at first smooth, more glossy, and more tender than the healthy membrane, in the end cannot be distinguished from it.

MM. Rilliet and Barthez state, as the result of their observation, that, in the cases of children, the diseased patches are almost always of the soft variety, that the submucous cellular tissue is rarely affected, that ulceration is slower in occurring than in adults, that the ulcer cicatrizes more rapidly, and that, in some instances, the inflamed patches, instead of ulcerating, undergo resolution. (*Traité des Maladies des Enfants*, ii. 353.)

The *minute solitary closed glands* of the ileum, frequently though erroneously denominated the *glands of Brunner*, from which they differ anatomically as well as in position, the true glands of Brunner being provided with excretory ducts, and situated in the duodenum, are usually affected in the same manner as the glands of Peyer; being enlarged so as to be distinctly visible, and either hard or soft, ulcerated, &c. These diseased bodies are scattered, in larger or smaller numbers, over the whole circumference of the lower portion of the ileum, and are sometimes found also in the colon. Occasionally the elliptical patches are alone affected; and it is asserted that, in some rare instances, the solitary glands have been diseased without any affection of the patches; but, in general, they are both more or less diseased. The aggregated glands are more frequently ulcerated than the solitary.

The mucous membrane of the ileum, between the affected glands, generally exhibits signs of disease, being sometimes thickened by sanguineous infiltration, sometimes softened, and sometimes of a white or grayish colour, though more generally reddened.

The *mesenteric glands* are as constantly diseased as those of the mucous membrane. Those corresponding with the morbid patches are most affected, but not exclusively so. The glands are reddened, enlarged, and softened, and sometimes exhibit traces of pus, though very rarely in such quantities as to form an abscess. As they become diseased with the patches, so do they also return along with these to the healthy state. The lymphatic glands elsewhere are also sometimes enlarged and reddened, but less frequently, and in less degree, than those corresponding with the diseased glands of Peyer.*

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* Certain German pathologists, among whom are Rokitanski and Engle, have put forth an opinion, that there is a morbid condition of the blood in typhus fever, disposing it to the deposition of a peculiar typhous matter, which bears to the general state of system the same relation that tubercle does to the tuberculous cachexia. The deposit may take place in various organs, as the spleen, lungs, intestinal mucous membrane, mesenteric glands, &c. It is of a yellowish, reddish, or brownish colour, at first of a rather firm consistence, but ultimately softening, and in the end either absorbed, or discharged by ulceration, &c. This opinion appears to be applicable to enteric or typhoid fever, between which and phthisis some analogy has long since been noticed, allowance being made for the acute character of the former, and the chronic character of the latter. As the typhus of the continent of Europe is in fact the enteric fever, or typhoid of Louis, it is to this affection, and not to the proper or British typhus, that the remarks of Rokitanski must be considered as applicable. Prof. Bennet, of Edinburgh, noticed the deposit referred to in the fever which prevailed in that city in 1846–7. Out of 63 cases examined by him, 10 presented the deposit in the spleen, 15 something analogous to it in the lungs, and 19 the disease of the glands of Peyer, as described by Louis, &c. (*Ed. Monthly Journ. of Med. Sci.*, Oct. 1847.) There can scarcely be a doubt that these were cases of enteric or typhoid fever. Dr. Wm. Jenner has noticed in this disease a deposit similar to that of Peyer's patches, and of the mesenteric glands, in the spleen, the walls of the gall-bladder, the lungs, and the kidneys. (*Lond. Med. Times and Gaz.*, vi. 287.) The substance thus deposited appears to be an exudation possessed of feeble powers of organization, in consequence of which it soon loses its vitality, and passes under the influence of chemical laws, being thereby softened, and partially at least converted into a puruloid liquid, such as is sometimes seen in the diseased mesenteric glands of enteric fever. Dr. Jenner suggests that the change may be a process of fatty degeneration, which is very probable. In the intestines, this softened matter is thrown off by ulceration; in the mesenteric glands and spleen it is probably absorbed. The idea has been advanced that the typhoid matter, like the tuberculous and cancerous, might have peculiar characteristic cells; but none such, I believe, have been observed under the microscope. (*Note to the second and fourth editions.*)

The lesions above described are those characteristic of the disease. There are numerous others, which, being incidental, require only a brief notice.

Other parts of the *alimentary canal*, besides those mentioned, are often diseased. The *pharynx* was found by Louis, in one-sixth of the cases, ulcerated, coated with false membrane, or infiltrated with pus. The *œsophagus* was ulcerated about as frequently, the ulcers being generally small, and sometimes numerous. The *gastric mucous membrane* was more frequently quite natural than in subjects who had died of any other acute disease; but it was nevertheless often morbid, being softened, reddened, thinned, mammillated, ulcerated, &c. The softening, which is the most frequent lesion, though sometimes inflammatory, is thought not to be so in most instances. The *duodenum* is not often much affected. Its lesions are similar to those of the stomach. The *colon* is almost always distended with air, sometimes enormously so. Occasionally isolated closed glands are found diseased like those of the small intestines; and a few small round patches, similar to those of the ileum, have been observed in a very few cases. The mucous membrane sometimes shows signs of inflammation, such as redness, softness, and ulceration.

The *spleen* is in almost all cases more or less altered, being generally enlarged and softened, and sometimes very much so. In some instances, it is four or five times the usual size, and softened to the condition of a bloody pulp, through which the finger will pass readily in any direction.

The *liver* is also frequently softened, though in a less degree, and is otherwise variously altered, but without any constant or characteristic lesion. The same may be said, in a still less degree, of the *kidneys*. The gall-bladder and the urinary passages have been found inflamed, in a very few instances. The *heart* is sometimes softened, and the inner coat of the *aorta* tinged red with blood, probably from imbibition. In relation to the *respiratory organs*, the epiglottis and larynx are sometimes, though rarely ulcerated, or coated with inflammatory exudation; the bronchial membrane is often reddened; and signs of congestion, inflammation, or apoplectic sanguineous effusion, are sometimes observed in the parenchyma of the lungs. The *brain* exhibits fewer evidences of disease than might have been suspected from the symptoms. In a large proportion of cases it is quite healthy. Sometimes the membranes appear congested or inflamed; serous effusion has been observed; and the substance of the brain has exhibited red points when cut. But no satisfactory connexion has been traced between these lesions and the symptoms of cerebral disorder evinced during life.

The blood drawn during life often does not apparently differ from its condition in health. It coagulates firmly, and, unless the disease is attended with some accessory inflammation, exhibits no buffy coat. But if pleurisy, pneumonia, or rheumatism be superadded, the inflammatory crust appears, though usually soft, and sometimes gelatinous. Sometimes, in low typhous cases, the blood is either but partially coagulable, or wholly uncoagulable. It has been found in both states after death. When uncoagulated, it is sometimes mingled with air. It generally contains a smaller proportion of fibrin than healthy blood.

Many of the above phenomena indicate the existence of inflammation in connexion with the fever; but the softness which has been noticed in so many organs is thought by the best pathologists not to be inflammatory, but rather the result of a direct loss of vital cohesion in the organs, either from debility, or the state of the blood.

Causes.—Nothing precisely is known of the cause of enteric fever. The circumstances of its production are very diversified. It is certainly often generated in situations where human beings are crowded together, with insufficient or unwholesome food, and a confined and vitiated air. Hence, it appears to originate especially in prisons, badly ventilated hospitals, large cities, camps, and ships. Many of the patients, brought every year with this disease to the Pennsylvania Hospital, are poor emigrants from on board ships. I have repeatedly known the disease to occur in young men, serving as resident physicians in hospitals. It is a well known fact, that young persons, coming from the country into large cities to reside, are very apt to be attacked with it. This has been observed in Paris. I have often noticed it in Philadelphia. The older residents are less liable to be affected.

From the above facts, it might be inferred that the disease is produced by effluvia from the human body, or human excretions in a state of decomposition. But it also not unfrequently originates in the pure air of the country. I have met with it in the healthiest regions of our middle states, even among the mountains.

It has been thought by many to be contagious. Many strong facts have been adduced, both in Europe and the United States, in support of this opinion. Thus, an individual coming into a healthy vicinity, from some place where the disease prevails, is taken ill with it; and several days afterward, others residing in the same house are seized, and the complaint spreads among the neighbouring population. Such instances are recorded by Dr. Austin Flint, of Buffalo, N. Y. (*Am. Journ. of Med. Sci.*, N. S., x. 21), by Dr. Samuel Jackson, formerly of Northumberland, Penn. (*Ibid.*, x. 349), by the late Dr. Nathan Smith, of Connecticut (*Bartlett on Typhoid Fever*, p. 80), and by several French authors. But against the opinion of its ordinary contagiousness is the fact, that it is constantly springing up in isolated cases, without any possible communication, and that, in such instances, it is very seldom if ever imparted to others. Though I have seen much of the disease in private and public practice, I never knew an instance, in which it could be clearly shown to be the result of contagion. If contagious at all, it must be so only feebly, and under peculiar circumstances.

It is very apt to prevail epidemically in country places; and one of its peculiar characters, when thus originating, is that it is apt to be confined to limited districts, in this respect very much resembling scarlet fever. In the British Islands, it appears to be occasionally associated with the typhous epidemics to which those regions are subject.

Certain individuals are much more predisposed to it than others. Age has a great influence over this predisposition. It rarely attacks persons beyond thirty years of age, still more rarely those beyond forty, and very seldom indeed those beyond fifty. Of 255 cases observed by Louis and by Chomel, 78 were from fifteen to twenty; 95, from twenty to twenty-five; 54, from twenty-five to thirty; 22, from thirty to forty; 5, from forty to fifty; and only 1 above fifty. I have attended a female patient who died of the disease in her fifty-fifth year. From the above statement it would appear not to occur in children below puberty. But the cases referred to were in hospitals, where I presume children are not admitted. The fact, at any rate, is, that the disease does occur, and has been frequently noticed in very early life. I have repeatedly seen it in children under ten.

It is generally admitted not to occur twice in the same person. This fact will explain its comparative unfrequency in the aged. Those who are susceptible to the disease will be likely to have it before they have attained middle life. The same fact has been adduced as an analogical argument in favour of its contagiousness.

It may occur at any season, but is probably most common in the autumn and winter. Such at least has been my observation in the Pennsylvania Hospital.

Fatigue, exposure to the sun, vicissitudes of weather, and mental disturbance, appear sometimes to have acted as exciting causes.

On the whole, the most rational view of the etiology of enteric fever, in the present state of our knowledge, seems to be, that an inherent predisposition to this disease exists in many persons, analogous, in some measure, to the tuberculous, the gouty, and the rheumatic predisposition, which is liable to be called into action by various exciting causes, perhaps by almost any cause capable of considerably disturbing the vital functions; but that all persons do not have the predisposition, and that it is generally exhausted by one attack of the disease. Hence its occurrence after fatigue, exposure to heat and cold, mental anxiety, &c. It is not improbable that the effluvia engendered by decomposing animal excretions, the contagious miasm of typhus itself, epidemic influence, and even marsh miasmata, may act as exciting causes of the disease in the predisposed. Admitting this to be the case, we are furnished with a clue to the varieties of character which it assumes. If the exciting cause have nothing of a depressing nature in it, we may have an open inflammatory or sthenic case. If it be depressing, as the contagion, animal exhalation, or epidemic influence which produces typhus, we shall have a low, asthenic, or typhous case; in other words, there may be typhus superadded to enteric fever. So, also, marsh miasm, in calling the predisposition into action, may produce that sort of complication, which we occasionally witness, of the remittent or bilious and enteric fevers. Even the occasional apparent contagiousness of the disease may be explained upon the same principle. Supposing the true typhus to be superadded to the enteric fever, the contagion generated by the former may be sufficient to induce the latter in other individuals who may have the predisposition. Indeed the typhous state, in whatever disease it occurs, may be supposed capable of generating a miasm, which shall produce the same state in other persons, and at the same time bring into action other disorders to which the system may be predisposed from inherent causes, or from external, such as epidemic influence. Hence, perhaps, the seeming contagiousness, sometimes, of typhous dysentery, malignant erysipelas, &c.

Nature.—This disease has been supposed to be a mere gastro-enteritis. But inflammation of the stomach is often wanting; and the course of the symptoms is in general wholly different from that of ordinary mucous enteritis. Dissection, moreover, has proved a distinction between the two affections by making known the diseased state of the glands of Peyer. Another opinion considers the disease, though differing from ordinary enteritis, as consisting essentially in the peculiar state of these glands; all the other phenomena resulting from this affection, just as the fever in pleurisy results from the inflammation of the pleura. But this is scarcely more tenable than the former. The general symptoms bear no certain relation in intensity to the degree of the local affection. It has, indeed, never been proved that this begins with the disease; and there is reason to believe that, in many cases at least, it may not commence till some days after the fever. Nor does there seem to be any necessary connexion between the intestinal affection and various other symptoms, such as the frequent occurrence of epistaxis at the commencement, the great tendency to stupor, the frequent bronchial inflammation, the peculiar condition of the spleen, the rose-coloured eruption, &c. The great probability is, that the disease of the intestinal glands is a sort of internal eruption, like that of smallpox upon the skin, and, like it, merely a characteristic attendant upon the complaint. It is not, indeed, certain that this glandular affection is absolutely essential. As to the real nature of the fever, we are in the dark, as we are, in fact, in relation to all the essential fevers. It seems to bear a close relation to the exanthematous fevers, not only by the intestinal affection, which, as before stated, may be looked upon as an internal eruption, but also by the rose-coloured spots, which are so commonly present at some stage of the disease. How it happens that the complaint should be sometimes inflammatory, and sometimes typhous, has been already explained. Its tendency, even when inflammatory in the beginning, to assume a low form analogous to typhus in the end, is probably owing to the general loss of power incident to the long continuance of the fever, and especially to the depravation of the blood, arising from disease of the structures through which nutriment reaches the circulation, namely, the intestinal mucous membrane and the mesenteric glands.

Diagnosis.—The most characteristic symptoms of this disease are the frequently slow and insidious mode of attack, the diarrhœa at the beginning or soon afterwards, the dull or heavy expression of countenance, the dusky hue of the face, the tendency to epistaxis, the cough and bronchial rales, and, after the seventh or ninth day, the dryness of the tongue and general diminution of the secretions, the rose-coloured eruption, the sudamina, the tympanitic abdomen, the deafness, the stupor or delirium, and the various signs indicative of the typhous state. The enlargement of the spleen, either sensible to the touch or discoverable by percussion, may have some weight in the diagnosis. The duration of the disease, exceeding generally that of other fevers, is also an important diagnostic character. It must not, however, be understood that all these symptoms are necessarily present in every case. The diagnosis may be very certain, though many of them should be absent.

One of the diseases with which enteric fever is most frequently confounded is the remittent or bilious fever. The latter, however, may usually be distinguished by its more regular and decided remissions, by the bilious vomiting and yellowness of skin which frequently attend it, by its shorter duration and its tendency to end in intermittent, and by the absence or comparative rarity of the characteristic symptoms of enteric fever, such as diarrhœa, epistaxis, dingy complexion, hebetude of expression, stupor, tympanites, and rose-coloured spots. Typhous symptoms are much less common in bilious than in enteric fever. Dissection confirms the diagnosis. While in bilious fever the stomach is more frequently inflamed, and the liver discoloured than in the enteric; the spleen is less diseased, and there is a total absence of the affection of the glands of Peyer, and of the mesenteric glands, characteristic of the latter complaint. Sometimes, however, the diagnosis is very difficult, especially when the bilious fever assumes the protracted typhoid form. I believe that, occasionally, the two complaints are commingled, in consequence of the co-operation of their causes. Thus, cases having all the essential characters of enteric fever occasionally end in intermittent; and bilious fevers, or affections which cannot be distinguished from them, sometimes show the signs of enteric fever during their progress.

The diagnosis between enteric and typhus fevers is reserved until we come to the latter of these affections.

Inflammation of the membranes of the brain sometimes bears a considerable resemblance, in the general aspect of the case, to enteric fever. But a close attention to the diagnostic characters above enumerated will generally enable the practitioner to reach a just conclusion. The diarrhœa, epistaxis, and heaviness without delirium in the first stage, and the tympanites, sudamina, and rose-coloured eruption of the second stage, are perhaps the most important symptoms in this relation.

The different forms of acute tuberculosis, especially in children, are sometimes difficult to diagnosticate from enteric fever, which they often very closely resemble in their symptoms and course. Whether the tuberculization affects the membranes of the brain, the lungs, or the peritoneum, there are often many points of resemblance; but, with attention directed to the subject, and a recollection of the more characteristic symptoms of enteric fever—the epistaxis, the dulness of countenance, the diarrhœa with the generally healthy looking stools, the tympanites, and especially the rose-coloured spots, there can in general be no great uncertainty in the diagnosis after a due period of observation. Dr. Wm. Jenner deserves credit for calling attention to this subject. (See *Lond. Med. Times & Gaz.*, May, 1853, p. 464.)

I have before mentioned that cases of enteric fever are sometimes mistaken for mucous enteritis. But, though the discrimination may not always be easy at all stages of the two complaints, yet there can be little difficulty when they are carefully observed throughout their course.

The practitioner should generally avoid a hasty decision at the commencement of the complaint. Many fevers closely resemble each other in the beginning; and, for the first three or four days of enteric fever, it is often impossible to decide with certainty upon its character.

Prognosis.—In this country, and as it has happened to fall under my observation, enteric fever, though a serious, is yet not a very fatal disease. It is, however, one of those complaints which put on very different degrees of violence, under different circumstances. From statistical reports, it is certain that, on some occasions, it is exceedingly fatal. In hospitals it may be expected to be more so than in private practice. Out of 140 cases observed by Louis, 52, or more than one-third, terminated fatally; while in 134 treated by M. Piédaguel, there were only 19 deaths, or about one-seventh. (*Dict. de Méd.*, x. 480.) In the Massachusetts General Hospital, the deaths, in the year 1830, were one in three and a half; in 1831, one in fourteen and a half; and in 1829, one in twenty-five. From November, 1836, to November, 1838, there were fifty-five cases, without one death. (*Bartlett on Typhoid and Typhus fever*, p. 100–1.) Nor does it appear that this great difference in the result could be referred to any difference in the treatment. There can be no doubt that, while certain epidemics of enteric fever are very mild, others are very fatal; and that the grade of its severity as an endemic differs greatly in different years.*

Nevertheless, if I am to judge from my own observation hitherto, there are few serious diseases which exhibit more happily the controlling influence of treatment than this. It is true that the complaint cannot be suddenly interrupted in its progress; but I have no doubt that it may often be materially shortened, and still more frequently conducted to a favourable issue, when, if without treatment, it would end in death. No case should be looked upon as absolutely desperate. There is no condition so low, no symptom so fatal, that death should be considered as inevitable. It is only in articulo mortis that the case should be given up. The most desperate state is probably that connected with intestinal perforation. Yet even here there is some slight chance of safety. The effused contents of the bowels may be confined by extravasated fibrin, and the intestinal opening may be closed; or a curable abscess pointing externally may take the place of diffused and fatal peritonitis. On the other hand, no case of the disease, however light it may be, can be looked upon as absolutely free from danger. All cases are liable to perforation, even the mildest. The prognosis, therefore, should always be cautious. Among the most unfavourable symptoms are steady and complete delirium, a notion on the part of the patient that nothing is the matter with him, profound coma, stertorous respiration, excessive subsultus or epileptic spasms, rigidity of the limbs and eyelids, abundant diarrhœa, hemorrhage from the bowels, involuntary discharges, great prostration, extreme feebleness and frequency of pulse amounting to 130 or upwards, coldness and clamminess of the skin, colliquative sweats, and very great abdominal distension. Yet there is no one of these which has not been followed by recovery. The favourable symptoms are diminished frequency of pulse and heat of skin, increased consciousness and interest in surrounding objects, a restoration of healthy secretion, and a disposition in the tongue to become moist and clean. The younger the patient, and the better his previous state of health, the more favourable is the prognosis.

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* Out of twenty-one cases of the fever, treated by myself in the Pennsylvania Hospital during the term of my attendance in the winter of 1850–51, but one proved fatal. The same proportion of deaths occurred in the following winter. In the winter of 1852–3, the number of cases was thirteen, and of deaths two, or one to six and a half. In the winter of 1853–4, the number of cases treated was thirty-one, and of deaths one. The general average of deaths for the four years, was, therefore, one out of seventeen cases. The cases admitted into the Hospital were of all grades of severity from the mildest to the most severe, and in all stages from the very commencement to near the close. The treatment employed was that recommended in this work. (*Note to the fourth edition.*)

Treatment.—As there is often diarrhœa at the commencement, or, if not diarrhœa, an unusual susceptibility to the influence of cathartic medicine, it is not advisable, as in most other fevers, to begin the treatment with active purging. Yet the bowels should be thoroughly evacuated, in order to obviate the injury arising from the contact of irritating matter with their lining membrane. A very small dose of sulphate of magnesia or of castor oil will generally answer the purpose; and, when there is much existing irritation, the latter of these medicines should be preferred. Sometimes it may be advisable, when there is pain at the same time with diarrhœa, to administer castor oil with fifteen or twenty drops of laudanum. Afterwards, throughout the complaint, the state of the bowels should be attended to. If the evacuations be spontaneous and free, as often happens, no opening medicine will be requisite. Should they, on the contrary, be scanty or wanting, means should be used to procure at least one full discharge daily. The gentlest laxatives, and those in small doses, will be sufficient. A fluidrachm or two of castor oil, a single Seidlitz powder, one or two drachms of Epsom salt, or half a drachm of magnesia may be given for a dose, and repeated if necessary. The magnesia should be preferred, when sourness of the breath indicates the presence of acid in the circulation. Rhubarb or one of its preparations is well adapted to the typhoid cases, in the latter stages. When the stomach is irritable, or cathartic medicines worry the patient, the same object may be effected by enemata. These should be mild in the early stages; but, at an advanced period of the disease, when the tympanites is considerable, may be very advantageously combined with the oil of turpentine. But I would again impress upon the young practitioner the necessity of avoiding irritating and drastic cathartics in this fever.

The bowels having been evacuated if necessary, the next indication is to obviate the febrile symptoms. When the pulse is full and strong, and sanguineous determination to the brain or other vital organ is obvious, blood may be taken from the arm to the amount of eight, twelve, or sixteen ounces; and cases occur in which it may be proper to repeat this operation. The remedy, however, is wholly uncalled for in numerous cases, and might be positively injurious in others. It must be borne in mind that this disease generally runs a certain course, and that this is sometimes very protracted. It is important, therefore, to husband the strength of the patient, especially as the natural tendency of the complaint is often to debility. Bleeding will not arrest it, and, if carried too far or improperly employed, may so prostrate the system as to cause it ultimately to sink under the malady. The main use of bleeding is to prevent local and disorganizing inflammation. When this indication is not presented, and the pulse is not very full and strong, it is best to omit the remedy altogether. It will seldom be proper to employ it after the first four or five days; though local bleeding may be resorted to at almost any stage, when called for by inflammation or active congestion of particular organs, even though there may be great debility, care being taken to proportion the amount of blood abstracted to the strength. I have known much advantage to accrue from the loss of an ounce or two of blood, in the most advanced stages, from the neighbourhood of a congested or inflamed organ. Leeches or cups to the temples or back of the neck, in cases of cerebral fulness or excitement, to the chest in cases of oppressed respiration, and to the abdomen when tender to the touch, are often useful.

Refrigerant diaphoretics should be employed from the commencement. Some recommend the antimonials; but they are in general too much disposed to irritate the bowels, and, when freely employed, have too sedative an influence except in the earliest stages. I prefer the citrate of potassa, in the form of neutral mixture, or effervescing draught. (See *U. S. Dispensatory.*) This may be given throughout the complaint, when the skin is hot and dry, and the pulse not very feeble. For the first few days, if the bowels should be quiet, the stomach not irritable, and the pulse pretty firm, this diaphoretic may be combined with small doses of tartar-emetic. When the nervous symptoms begin to appear, spirit of nitric ether may be added to it; and, in all stages, should it produce uneasiness of stomach or bowels, it may be usefully combined with small doses of laudanum, solution of sulphate of morphia, or other preparation of opium. Some prefer solution of acetate of ammonia to the citrate of potassa. Either of these medicines may be given every two hours during the day, and in the night if the patient be awake and restless; but, in this fever, it is almost always best that the nights should be passed in sleep. For this purpose, when determination to the head, or the existence of stupor does not contraindicate the remedy, a dose of Dover's powder, or an equivalent quantity of opium and ipecacuanha in pill, or some other preparation of opium which may agree better with the patient, may be given at bedtime.

Cold ablutions are very useful in abating the heat of the surface. The legs, arms, and temples, should frequently be sponged with cold water; and, when the skin is uniformly hot and dry, the application may be extended to the whole surface. In cases attended with much debility, diluted spirit may be substituted. The patient should also be allowed cold drinks, and, if he wish it, a little ice in his mouth, when not greatly prostrate.

Certain local affections often require attention. Severe headache may be treated by leeches, and applications of cold water or ice in bladders. For pains in the abdomen, with more or less flatulent distension, small local bleedings, warm fomentations or emollient cataplasms, and rubefacients or blisters may be used. Should considerable tenderness be found to exist in any part of the abdomen, whether at the epigastrium, in the right iliac region, or elsewhere, a few ounces of blood should be taken by leeches or cups from the tender spot. Large mush poultices, covering the whole abdomen, and kept steadily upon it day after day, are very useful. Sometimes it may be advisable to mix a little mustard or other rubefacient with them. In obstinate cases of abdominal tenderness, it may be proper to apply a blister. The diarrhœa may generally be allowed to take its course; but, should it become exhausting, it should be checked by small doses of opium and ipecacuanha, to which acetate of lead, kino, extract of rhatany, or pure tannic acid may be added, if necessary. Nervous symptoms, such as restlessness, general uneasiness, jactitation, wakefulness, and slight subsultus, may often be quieted by sweet spirit of nitre, Hoffmann's anodyne, or camphor water; and opiates may be used for the same purpose when not contraindicated.

In the more favourable cases of the disease, no other treatment than that above pointed out will be required. But very often, after the seventh or ninth day, a condition of things supervenes which must be met by other measures. There is now a general deficiency of secretion. The tongue is dryish, the skin dry, and the urine scanty. The pulse, though perhaps more frequent, is neither so full nor so strong as at first. Some degree of delirium, or an increase of stupor often supervenes, and the abdomen becomes tympanitic. Without any diminution in the violence of the disease, a close examination will show that the energy of the vital actions has abated. Under these circumstances, I know of no remedy so effectual as mercury, given so as very slightly to affect the gums. It is indicated by the general failure of the secretions, and the general languor of the vital functions. It is also indicated as an antiphlogistic remedy. One of the great dangers is now disorganization from inflammation of some important organ. After direct depletion, nothing is so efficient in arresting this process as mercury. At the present stage of enteric fever, general bleeding is inadmissible; and the most that can be done, in the way of depletion, is occasionally to abstract a few ounces from the vicinity of the inflamed organ by leeches or cups. Besides, it is not improbable that mercury may serve in some degree to arrest the progress of disease in the glands of Peyer, and to promote resolution of the inflamed patches. But the impression should be made in the mildest way. Large doses of calomel are out of the question. I usually prefer minute doses of the blue mass, given at short intervals, as, for example, a grain every two hours, until the mouth is affected. When the stomach is not irritable, this may with great propriety be associated with small doses of ipecacuanha, which tends to soften the skin and promote bronchial secretion; and opium is frequently also an excellent addition. In cases admitting this combination, the formula given below may be used.* Minute doses of calomel, as the quarter or sixth of a grain, may be substituted for the blue mass, if preferred by the practitioner. The neutral mixture may be omitted during the administration of this remedy, or may be given in connexion with it, according to the condition of the skin, and the state of the pulse, being always indicated when the surface is hot and dry, and the circulation accelerated, but not much enfeebled. The mercurial should be continued until the gums are slightly touched, and then either diminished gradually, or omitted. Under its influence, the tongue not unfrequently becomes moist, the skin relaxed, and all the other symptoms ameliorated; and the patient recovers without further treatment. Severe ptyalism should be scrupulously avoided.

But, should the symptoms not yield; especially, should the tongue become very dry, and the abdominal distension remain undiminished, the oil of turpentine will prove an excellent remedy. I cannot too strongly impress upon the profession my convictions of the importance of this medicine. It may be employed in all cases, in the advanced stages of this disease, when the tongue is dry. But there is a particular condition, and that a not uncommon and sometimes a very dangerous condition, in which I have very often employed it, and hitherto have very seldom known it to fail. In the description of the symptoms, it was stated that, in the latter period of the disease, the tongue, instead of cleaning gradually from the edges and tip, often parts with its fur quickly and in large flakes, generally first from the middle or back part of the surface, which is left smooth and glossy, as if deprived of its papillæ. It was also stated that if, after this process, the tongue remain moist, a slow convalescence may be pretty confidently calculated on. But it not unfrequently happens that, during the progress of the cleaning process, or after its completion, the surface of the tongue becomes quite dry, and the process, if not finished, is suspended. At the same time, there is generally an increase of the tympanites, and an aggravation, or certainly no abatement, of the other symptoms. Two cases of this kind I had seen terminate fatally, one in my own practice, and a second in that of a medical friend. One of them was examined after death; and ulcers were found in the ileum near the ileo-cæcal valve. This case happened so early as the year 1823. Ascribing the aggravation of symptoms which attended the drying of the tongue, after cleaning, to the occurrence of ulceration in the ileum, I inferred that the oil of turpentine, which had been recommended in ulcerations of the intestines, might prove useful here, and determined to employ it in similar cases. I did so, and, as before stated, have seldom found it to fail, under the circumstances mentioned, though I have very frequently employed it, both in private and public practice.* It acts in some measure as a stimulant, but chiefly, I believe, as an alterative to the ulcerated surfaces in the intestinal mucous membrane. It should be given in doses of from five to twenty drops every hour or two, and is best administered in emulsion with gum arabic, loaf sugar, and water; a little laudanum being occasionally added, if it disturb either the stomach or the bowels. My usual dose is ten drops every two hours. In the course of twenty-four, or at most forty-eight hours, some amelioration of the symptoms may be observed. The tongue becomes gradually moister, and covers itself with a whitish fur; the tympanitic distension ceases to augment, and after a time diminishes; the pulse becomes less frequent, and the skin less dry and harsh; and the patient enters slowly but regularly into convalescence, often without any other remedy. As the case improves, the quantity of the oil should be diminished; but care should be taken not to omit it too hastily. Not unfrequently, especially in the lower classes, the practitioner is not called upon until the disease has assumed the aspect above referred to. He finds the tongue red, smooth, and dry, the abdomen tympanitic, and other symptoms which leave no doubt of the disease. I have known such cases to run on for a considerable time, without material change, under various treatment, and have seen them yield immediately to this remedy. I will repeat, that the oil of turpentine may be used, with great hope of benefit, in any case of enteric fever, in the advanced stage, with a dry tongue; but, in the cases above referred to, with confidence of success, so far as an experience of more than thirty years may be admitted as a ground of confidence.[*] I have also seen it strikingly useful in the advanced stages of lingering cases in which, though the tongue may be whitish and moist, there seems to be some impediment to recovery, probably connected with an indisposition of the ulcerated surfaces to heal. Such cases, under the use of the oil, often enter immediately into convalescence.

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* R.—Mass. pil. hydrarg. gr. xij; Ipecacuanhæ pulv. gr. ij; Opii pulv. gr. ij; Aquæ, q. s. Misce et fiant pil. no. xij. S. One to be taken every hour, every hour and a half, or every two hours, according to the urgency of the case.

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* At the time of the publication of the second edition of this work, I had met with no unsuccessful case, where the oil of turpentine was used in the particular condition referred to in the text, however unpromising the symptoms might have appeared. Since that period, I have had two fatal cases in the Pennsylvania Hospital, which, however, upon post-mortem examination, exhibited pathological conditions which amply accounted for the failure.

In one of these cases, an enormous amount of disease was found in the ileum; the patches exceeding, in number, size, and elevation, any that I remember to have seen before, and obviously beyond the reach of remedies.

In the second case, the patient was apparently doing well under the oil of turpentine. The tongue had become moist, the abdominal distension was diminishing, and the case was exhibited to the attending class as in a fair progress towards convalescence. Suddenly, the symptoms of violent peritonitis came on, and death occurred in six or seven hours. Examination showed the ulcerated glands of Peyer in a healing state; but, on slitting up the ileum, about two feet from the cæcum, the orifice of a pouch presented itself, from half to three-quarters of an inch in diameter, which descended between the laminæ of the mesentery for about an inch and a half, and at the bottom exhibited a small ulcer, probably in one of the isolated glands, which had perforated the coats of the bowel, and allowed the escape of its contents. The oil of turpentine had not been able to reach this ulcer at the bottom of the cul-de-sac, filled as it was with mucus, and consequently had not exercised the same curative influence upon it, as had been produced in the accessible ulcerations of the general surface. The specimen is now in my possession. (*Note to the third edition.*)

The debility, attendant upon the advanced stages of the disease, is very often such as to render the use of tonics and stimulants absolutely essential. The period at which it becomes necessary to have recourse to these medicines varies greatly in different cases. Sometimes, in very feeble constitutions, or during typhous epidemics, or when the patient has been exposed to peculiarly debilitating influences, it is very early after the commencement of the disease; but, much more frequently, it is not until some time in the second or third week. The practitioner must be influenced by the state of the pulse, that of the skin, and the general evidence of a typhous condition of the symptoms. When the pulse is at once slow and feeble, the skin cool, and the tongue and teeth incrusted with dark sordes, there can be no doubt of the propriety of using stimulants; and the happiest effects are sometimes experienced from them under such circumstances. But it much oftener happens that the pulse is very frequent while it is weak, and the skin at least partially hot; and, even under such circumstances, they are often essential. Sometimes it becomes necessary to pursue a tentative course. Should tonics or stimulants, carefully given, increase the frequency of pulse and heat of skin, and, instead of moderating, augment delirium or stupor, they must be omitted. Should they, on the contrary, lessen the frequency and increase the fulness of the pulse, relax the skin, moderate delirium, relieve nervous disorder, and promote refreshing sleep, they may be considered as acting favourably. Upon the whole, the most suitable stimulant is probably wine-whey, of which from a tablespoonful to a wineglassful may be given every two hours. When the strength is beginning to decline, without any abatement of the febrile heat, it may be alternated, in the smallest dose mentioned, with the neutral mixture. Afterwards, it may be given in conjunction with the mercurial, or with the oil of turpentine. As the strength becomes reduced, it is often advisable to superadd carbonate of ammonia; and it may be necessary to have recourse to the more powerful influence of pure wine or brandy.[†] In cases of sudden and great prostration, sulphuric ether may be employed. Opium is an admirable remedy in this disease. In the latter stages, it proves useful by its stimulant power, and serves, throughout, various other important purposes, such as relieving nervous disorder, promoting sleep, checking diarrhœa, and inducing perspiration. It may be given whenever the pulse is not too full and strong, and the brain is not diseased. Should it augment delirium and stupor, it must be omitted. In the last stages, it should be given pretty freely when indicated as a stimulant; in the dose, for example, of half a grain or a grain every four, six, or eight hours. Tonics may often be advantageously combined with the more diffusible stimulants; and, in some cases in which the debility is not great, may be substituted for them. The infusion of serpentaria with a little sweet spirit of nitre may be tried, and persevered in if it agree well with the stomach. The preparations of bark are also sometimes useful, though less so than in remittent or proper typhus. Either the compound infusion (U. S. Ph.), or sulphate of quinia may be employed, and these may be given in connexion with serpentaria. I have occasionally found advantage in combining sulphate of quinia with the oil of turpentine. The medicine should be used in moderate doses frequently repeated, and omitted if found materially to disturb the stomach, or to increase the fever. The large doses of quinia, sometimes recommended, are, I believe, wholly inapplicable to this disease. This medicine acts in enteric fever only as a tonic, and not by its antiperiodic power. It is incapable of arresting the disease. I have frequently found it necessary to drop it in consequence of unpleasant effects, and at present use it less than formerly. When coldness of the skin is connected with debility, powerful rubefacients should be used in connexion with the internal stimulants. Hot oil of turpentine, Cayenne pepper heated in brandy, or solution of ammonia properly diluted, may be rubbed upon the surface of the body, especially upon the extremities; sinapisms may be applied to the legs and arms; and blisters of Spanish flies to the inside of the thighs or to the trunk, care being taken not to leave them on longer than is necessary merely to produce a rubefacient effect. Danger of sloughing from excessive stimulation to the extremities must be especially guarded against in enteric fever. Care must be taken to keep up the temperature of the surface also by artificial heat, as by hot bricks, bottles of hot water, &c.

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[*] See a paper by the author on the use of oil of turpentine in Fevers, in the *N. Am. Med. and Surg. Journ.*, i. 272, April, 1826.

In a letter to the author, dated Feb. 5th, 1850, Dr. T. S. Jarmon, of Tennessee, states that he has found a mixture of copaiba with the oil of turpentine, in equal proportions, to succeed better than the oil alone.

[†] Carbonate of ammonia should be given in doses varying from two and a half to ten grains, every hour or two, and is best administered in emulsion. The following formula may be used. ℞. Ammoniæ carbonat. ʒij; Acaciæ pulv., Sacch. alb. āā ʒij; Aq. menth. p., *vel* Aq. fluv. f℥vj. Misce. From a teaspoonful to a tablespoonful to be taken every hour or two, diluted with a little water. *Wine-whey* should be prepared by adding one part of good wine to two parts of boiling milk, and straining after coagulation. *Brandy* is often advantageously administered in the form of *milk-punch*, made with one part of

It is very important to attend to various local affections, or incidental complications, in the advanced stages. In cases of obstinate delirium or coma, great advantage is often derived from shaving the head, and applying a blister over the whole scalp; nor should this remedy, as too often happens, be postponed to so late a period that neither it, nor any other, can be of much avail. In excessive subsultus, great nervous restlessness, jactitation, &c., the antispasmodics have been recommended, as musk, assafetida, and camphor. Sometimes they may be useful, but they often also fail, and the case must be trusted to remedies addressed to the general state of the system. Musk may be used in singultus, with great hope of benefit. Hemorrhage from the bowels should be arrested by acetate of lead, kino, or extract of rhatany, with opium. In copious epistaxis, should ordinary remedies fail, recourse must be had to plugging the nostrils both posteriorly and anteriorly. Erysipelas is best treated by mucilaginous applications, or by the local use of nitrate of silver or tincture of iodine. In the pulmonary congestion which is occasionally an alarming feature of the advanced stages, much good will accrue from the extensive ap-

brandy and two parts of milk, and given in doses of one, two, or three tablespoonfuls every hour or two. It is obvious that, in relation to the quantity of stimulus used, much must be left to the judgment of the practitioner.

plication of dry cups over the chest. In cases of peritonitis from intestinal perforation, the only hope is in the use of large doses of opium, as proposed by Graves and Stokes, in connexion with perfect rest, and the avoidance of all substances internally which can in any way disturb the bowels.* To prevent the formation of sloughs from pressure and friction, the patient's position should be frequently changed, small down pillows should be placed under the body, or hollow pillows so as to avoid pressure on prominent points; and the parts should be bathed occasionally with spirit, or protected by lead plaster. It is highly important to attend to the state of the bladder, and, if there be retention of urine, to draw it off with a catheter.

The above course of treatment, so far as medicines are concerned, is that which has appeared to me to be the most successful. It must not, however, be concealed that others have been proposed, and their claims to superiority supported by appeals to experience. Some have strenuously recommended an emetic at the commencement, and purgatives afterwards, more or less active, throughout the disease. Others trust chiefly to bleeding in the early stages. I have been told that Dr. J. K. Mitchell, Professor of the Practice of Medicine in the Jefferson College of Philadelphia, has had great success with the internal use of nitrate of silver. My friend, Dr. John L. Atlee, of Lancaster, Pennsylvania, informs me that he has for many years been in the habit of depending chiefly upon acetate of lead, which he has found exceedingly effectual.† Alum and chloride of soda have also been severally recommended as having specific virtues. The mercurial treatment has recently been recommended as a novelty in France, having been introduced into notice by M. Serres, who employs the black sulphuret of mercury internally, and frictions over the abdomen with mercurial ointment; and M. Becquerel claims great success for this treatment. I have been in the habit of employing mercury carefully in bad cases of the disease for more than twenty years, and have recommended it in this work since its first publication. When there is reason to believe that the disease is complicated with remittent or bilious fever, and especially when, under such circumstances, it terminates in intermittent fever, sulphate of quinia should be used without hesitation, and with a freedom proportioned to the urgency of the symptoms.

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* A case came a few years since under the notice of the author, in which, during apparent convalescence from an attack of the fever, when the pulse had become natural in frequency, and all the symptoms were favourable, the patient was suddenly attacked with violent pain in the right iliac region, extending over the right side of the abdomen, with great distension, exquisite tenderness on pressure, and extreme frequency of the pulse. It was the opinion of Dr. Gerhard, who was the attending physician, and myself, that perforation had taken place. We put the patient under the powerful influence of morphia, applied a blister over the abdomen, and had the satisfaction to see our patient ultimately recover. (*Note to the third edition.*)

A similar case has since occurred to the author in the Pennsylvania Hospital with the same favourable result, for the particulars of which the reader is referred to the *Transactions of the College of Physicians* of Philadelphia (N. S. i. 418.) It must be confessed, however, that the value of such observations is diminished by the publication of certain cases by Dr. Thirial, which go to prove that violent and fatal peritonitis, which might readily be mistaken for peritonitis from perforation, occasionally occurs in enteric fever without any discoverable opening in the bowel. (See *Philad. Med. Examiner*, N. S. x. 120.)

† At my request, Dr. Atlee has furnished me with a particular account of his method of administering acetate of lead; and the following is an extract from his letter on the subject, dated Lancaster, Nov. 4th, 1848. "The primæ viæ are first unloaded by castor oil, sulphate of potash and rhubarb, or some of the milder neutral salts; and the patient immediately placed upon an absolute diet—and by this I mean *cold* water, toast-water, or a *very* weak gum water. Should the fever be prolonged beyond the third or fourth day, and its character become fairly established, I then resort to the acetate of lead, in doses of from one to three grains, carefully and perfectly dissolved in a few drops of vinegar and half an ounce of river or distilled water, and given every 2, 3, or 4 hours, according to the frequency of the symptoms; and the treatment is steadily persevered in as long as the enteric symptoms continue. In one or two instances I have continued it for 14 or 15 days; during the whole of which period, there was no other internal medication, beyond an occasional small dose of castor oil. Of course, I have not used it to the exclusion of all the other established means of combating fever; viz., local depletion, cold ablution, counter-irritation, &c., &c., where these are indicated; but my confidence in the effects of the lead has been so firmly established, that I do not always resort to them. Nor has it deceived me. I do not know that I have ever lost a patient, where the case was treated from the commencement, as above indicated.—*Note to the second edition.*

Large doses of sulphate of quinia have been recommended in the early stages as an abortive to the fever; but I have already stated my belief, founded both on experience and my views of the nature of the disease, that this treatment must fail in enteric fever. Small and frequently repeated doses of morphia have been recommended as an exclusive treatment by Dr. H. N. Bennett, of Connecticut (*N. Y. Journ. of Med.*, N. S., viii. 357); and Dr. W. C. Norwood, of S. Carolina, speaks favourably of the American hellebore or Veratrum viride, which, however, if used at all, should be employed with great caution.

Attention to the diet is all important in enteric fever. In the early stages, it should be very light, consisting chiefly of liquid substances, which may also answer the purposes of drink. Solution of gum arabic, barley water, rice-water, toast and water, weak solutions of tapioca, sago, or arrowroot, very weak gruels of oatmeal or Indian meal, molasses and water, vegetable jellies mixed with water, and other similar preparations may be successively, or interchangeably employed; and the patient may be allowed, if he desire it, to swallow the juice of sweet grapes and oranges, taking care to reject the solid portions of these fruits. Cold lemonade or orangeade, carbonic acid water, and pure iced-water in moderation, may also be used as drinks. At a more advanced period, in the second week, for example, when the symptoms of debility begin to show themselves, it will be necessary to support the strength by a more nutritious diet, which, however, should not be stimulating. Preparations of tapioca, sago, or arrowroot, of a nearly gelatinous consistence, thick gruels, or panada, may now be given, flavoured with nutmeg or other spice and sugar, and not unfrequently with wine. It will often be desirable to give these in certain quantities, at certain intervals, so as to insure that enough is taken. I have generally been in the habit of directing a wine-glassful to be given every two or three hours, or less frequently, according to the apparent strength of the patient. A cup of tea may also be allowed, with dry toast or a water-cracker, morning and evening. Still further on in this stage of the disease, milk, in small quantities frequently repeated, will often be found to suit the case admirably well. A tablespoonful of it may be given every hour or two through the day; and, if the stomach be irritable, it may very properly be associated with an equal quantity of lime-water. It may be added also to the farinaceous preparations already referred to. In the last, or prostrate stage, it is proper that the diet should be not only nutritious, but also stimulating. Animal broths or jellies may now be given; and, in the lowest cases, it is necessary to resort to egg beat up with wine, milk-punch, and the essence of beef or mutton. (See *page* 224.)

Throughout the whole case, the greatest attention should be paid to cleanliness and ventilation; and, when the atmosphere cannot be sufficiently purified by these means, as sometimes happens when many patients are crowded together, recourse may be had to the corrective influence of chlorine.

The period of convalescence often requires a close watchfulness on the part of the physician. The bowels should be kept daily open, if necessary, by the mildest laxatives or enemata; but active purgatives should be scrupulously avoided, as they endanger injury to the ulcerated surfaces, and sometimes induce relapses. Not unfrequently the patient is affected with profuse and exhausting sweats at night. These are ordinarily best encountered by the mineral acids and simple bitters. Convalescence appears to be sometimes very much retarded by debility of the alimentary canal, which disables the ulcerated surfaces from healing. A species of hectic excitement is sustained for a long time. The pulse remains frequent, something like a febrile paroxysm occurs every afternoon, and the patient sweats copiously at night. Under these circumstances, I have found nothing so effectual as sulphate of quinia. The diet in convalescence should be nutritive, but mild and easily digested, and the patient should be especially guarded against an excessive indulgence of his appetite. I have known death, after the apparent commencement of convalescence, to result from the free use of peaches. Premature and fatiguing exertion should be avoided; and the patient should be brought gradually back to his accustomed modes of life, without any strain upon his mental or physical powers.

Article V.

TYPHUS FEVER.

Syn.—Typhous Fever.—Typhus Gravior.—Spotted Fever.—Petechial Fever.—Putrid Fever.—Camp Fever.—Ship Fever.—Jail Fever.—Hospital Fever.

The origin of the terms *typhus*, *typhous*, and *typhoid*, (from τυφος stupor,) indicates the general character of the affections to which they have been applied. But, as they have been rather vaguely used by authors, it will be proper to state precisely the meaning attached to them in this work.

There is a peculiar febrile disease, distinct from all others, characterized by a peculiar group of symptoms, and produced probably by a peculiar cause, to which the name *typhus*, or *typhus fever*, is attached; the substantive term being used adjectively in the latter name, as we say ship fever, jail fever, &c. But a state of system, identical or closely analogous with that which characterizes typhus fever, is frequently met with in other febrile diseases, as a mere incidental accompaniment. To this state of system the epithet *typhous* or *typhoid* is applied, the latter being preferred to the former, when it is wished to imply resemblance only, and not sameness. Thus, we speak of a typhous or typhoid condition of bilious fever, yellow fever, smallpox, measles, pneumonia, dysentery, &c.; or, with greater brevity, of *typhous pneumonia*, *typhous dysentery*, &c.; by the latter phraseology, however, generally implying a more thorough incorporation of the typhous constituent with the principal affection than by the former. This distinction between the peculiar disease named typhus fever, and the analogous state of system met with in other diseases, indicated by the adjective epithets typhous and typhoid, it is important to bear constantly in mind, in order to avoid serious errors.

The existence of such a disease as typhus fever is universally admitted. But opinions are not equally united in relation to its identity or non-identity with the disease styled in this work enteric fever, but more generally known as typhoid fever. Many consider the two as constituting varieties of the same disease, differing only in the superaddition of a certain intestinal affection, in the case of enteric fever. A greater number probably believe them to be entirely distinct, though having in many instances certain very striking points of resemblance. The latter opinion is the one adopted by the author.

Differences between the two diseases sufficiently fundamental, in his estimation, to justify this opinion, will be pointed out under the heading of *diagnosis*. It is sufficient here to say that, from the time of Huxham downwards, authors have observed such obvious and important differences in the symptoms and cause of fevers called typhous, that they have been compelled to give distinct descriptions of two varieties, designating the one as malignant typhus, typhus gravior, &c., the other as *typhus mitior*, *nervous fever*, &c.; and practitioners who have witnessed both have been under the necessity of making a similar discrimination in their own minds. While a student of medicine, and for some years after beginning to practise, I had many opportunities of seeing the proper typhus fever, which prevailed epidemically in different parts of the United States, beginning in New England so early as 1807, reaching our own neighbourhood in the winter of 1812–13, and continuing to lurk in the lanes and alleys, among the crowded poor of Philadelphia, until the year 1820–1821, when it disappeared. The disease again showed itself in our city in the spring and summer of 1836, being confined, for the most part, to a certain portion of the population in the most wretched quarter of the town, and was soon afterwards once more extinguished. During the eight or nine subsequent years, though prescribing in the Pennsylvania Hospital during one-third of each year, I saw only four cases of the disease, and all of these were in strangers. Yet, throughout all these periods of exemption, I had been constantly witnessing cases of a slow fever, often inflammatory in the beginning and becoming typhoid in its progress, which was formerly designated among us as nervous fever, slow remittent, &c., differing alike from the epidemic typhus, and the endemic bilious remittents of our country. Upon the appearance of the excellent work of Louis on typhoid fever, I at once recognized that disease in his descriptions, and have since entertained no doubt whatever of its distinctive character. There are undoubtedly strong resemblances between certain cases of the enteric and typhus fevers; and, though in most instances easily distinguishable by the obvious symptoms, they were often confounded, until the work just alluded to placed us in possession of the means of a more accurate diagnosis. But it is highly probable that the two diseases are sometimes combined, in consequence of the simultaneous action of their causes; and hence the occasional difficulty of discrimination, which has induced many practitioners, especially the British, to consider them as in fact identical. But we might with as great propriety confound bilious remittent fever or pneumonia with typhus fever, because, when the latter becomes epidemic, the two former often take on a certain degree of its character, and thus give rise to mixed diseases. The enteric fever no doubt, during epidemics of typhus, assumes more of the typhous nature than under other circumstances, and is therefore more readily confounded with that disease; though post-mortem examination will almost always detect the difference, even here.*

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* Since the above account was written, we have had ample opportunities of witnessing typhus fever in the Pennsylvania Hospital, occurring among the emigrants from Ireland during the year 1847 and subsequently. My views have not been altered by these cases. Among the emigrants there have been some with enteric fever, as there always had been, at the periods when none came with typhus. But the greater number, originating on shipboard, were of the latter affection. In general, there has been little difficulty in making a diagnosis between the two classes of cases, during the progress of the disease; and, in every fatal case that has occurred, the correctness of the diagnosis has been established by the result of post-mortem examination. In accordance, however, with what has been stated in the text, there have been a few obscure cases, which may have been mixtures of the two diseases, but the precise pathological character of which we had no means of determining with certainty, as they recovered.—*Note to the fourth edition.*

Symptoms.—More frequently perhaps than in most other fevers, the patient is affected preliminarily more or less with certain morbid sensations, such as pain, soreness, or a feeling as of weariness in the back and limbs, headache, fatigue after slight exertion, general uneasiness, constriction of the epigastrium, deficient appetite or even nausea, mental depression or irritation, restlessness, and want of sleep. Sometimes the disease begins and advances so gradually, that it is difficult to fix the precise time of attack. But, in the great majority of cases, after a longer or shorter duration of some of the above symptoms, and occasionally without them, the patient is seized with chilliness and feelings of great debility, which compel him to take to his bed. There are usually at the same time sharp pains in the back, loins, head, and lower extremities, or in some one or more of these parts, which are sometimes exceedingly severe and even excruciating. Occasionally, also, there are nausea and vomiting, though these are not common. This initial or cold stage varies greatly in degree and duration. Sometimes it is so slight as to be scarcely perceptible; sometimes exceedingly severe and protracted, with a cool and pale skin, shrunken and anxious features, a frequent, irregular, and very feeble pulse, great oppression, and universal prostration, in which death may occur with but feeble and ineffectual attempts at reaction, or without any reaction whatever. Cases of this kind, however, are very rare. In the vast majority of instances, febrile reaction occurs sooner or later, often in a very short time, sometimes not for twelve hours or more; and frequently there is an alternation of chilliness and heat several times, before the latter becomes permanent.

The febrile condition, when established, is marked by the usual symptoms of a hot dry skin, accelerated pulse, hurried breathing, furred tongue, thirst, anorexia, and headache. The pulse at this period is often full, and possessed of a certain degree of strength; but it is generally easily compressible, and less firm and tense than in ordinary fevers, with much less appearance of excitement. The tongue is usually moist, and whitish or yellowish-white. Occasionally there is nausea or vomiting; but these are not ordinary symptoms, and are often entirely absent throughout the complaint. In general the bowels are costive, and stools are not procured without medicine. Even at this early period, the appearance of the face is often peculiar, being of a darkish-red or dusky hue, with injection of the eyes, and sometimes congestion of the mucous membrane of the nostrils and fauces. The mind also exhibits signs of sluggishness, and the thoughts often have some degree of confusion. The headache, which is felt most commonly over the brows, is often exceedingly severe, feeling, to use an expression common with the patients, as though the head would burst.

These symptoms continue for several days, gradually increasing until the disease attains its height. The surface is now universally hot, with little disposition to perspiration, and the heat is of that peculiar kind, usually called *calor mordicans* or *mordax*, which produces in the hand a sense of pungency as well as burning. Examined by the thermometer, the temperature of the surface is usually from 100° to 106° F., and, in some rare cases, as high even as 109°. The pulse is remarkably frequent, and generally feeble, beating from 100 to 120 or 130, and sometimes as high as 140, 150, or even 160 in a minute, so that it can scarcely be counted. The respiration also is very frequent; and, when examined by the stethoscope, is found feeble and imperfect in the back and lower part of the chest, which is also dull on percussion. (*Gerhard.*) A paroxysmal tendency is often observed in the febrile symptoms; an exacerbation generally taking place towards night, and a remission in the morning.

A characteristic eruption now generally makes its appearance, which gives the disease a claim to be ranked among the exanthemata, and has served as the origin of the names of spotted and petechial fever sometimes applied to it. This consists of numerous small reddish spots, varying in size from that of mere specks to an eighth, a quarter, or even half an inch in diameter, though generally very minute. They are confined to no particular portion of the surface, occurring upon the neck, trunk, and extremities, and sometimes covering the whole body, giving it occasionally an appearance not unlike that of measles. The eruption is in general not elevated or scarcely elevated above the surface, and is variously coloured, red, purplish, violet, or almost black; being usually brighter coloured in the early stages, and in mild cases, and darker in the declining stage, and in malignant cases. Sometimes the spots disappear under the pressure of the finger, but in general slowly and imperfectly; and, when of a dark-purple or livid hue, are usually not affected by pressure at all, being in fact true petechiæ. Though usually very numerous, they are sometimes few, and cases now and then occur in which they are wholly wanting. They appear at different periods, from the third to the thirteenth day, but usually from the fifth to the eighth; and generally last eleven or twelve days. Sometimes they fade for a time, and again appear in the progress of the case. They are occasionally accompanied with sudamina, which sometimes also appear in great numbers over the body, without the red eruption.

The tongue in this stage usually assumes a brownish colour, and becomes more or less dry, especially in the middle; while, in some cases, a dark sordes begins to collect upon the teeth, gums, and lips. Sometimes the tongue is clean, smooth, and glossy, and sometimes, in the progress of the disease, assumes an appearance not unlike that of raw beef. There is in general a total want of appetite, but less disgust for food than in most other fevers. The discharges from the bowels, procured by medicine, are often dark-coloured and offensive. Sometimes diarrhœa comes on; and this has been especially the case with the disease as it has appeared among the emigrants from Europe. The abdomen is sometimes quite flat, sometimes moderately swollen and tympanitic. The urine is usually scanty. The colour of the face deepens, sometimes into a dark-red, purplish, or livid hue, which completely overspreads it; and the eyes have a turbid appearance. Occasionally there is bleeding at the nose. A peculiar and characteristic odour exhales from the body, which has been variously described, but which can be appreciated only by those who have once perceived it. I have noticed something similar to it in confined rooms, in which numbers of persons, diseased or otherwise, have been long crowded together, and no attention paid to ventilation or cleanliness.

According to the observations of Mr. G. W. Edwards, the urine is generally pale, of a rather low specific gravity, and in the early period of the disease uniformly contains albumen. (*Ed. Month. J. of Med. Sci.*, xvii. 235.)

The nervous symptoms are now prominent. Though the headache and general pains may be less severe, there is often a universal tenderness of the skin, which causes the patient to shrink or complain when pressure is made upon any part of the body. Dizziness, confused vision, buzzing or ringing in the ears, and partial deafness are not uncommon symptoms.

The characteristic stupor of the disease becomes more and more developed. Sometimes it deepens into profound coma; but this is comparatively rare. In general, the patient can be roused with little difficulty, and will answer questions, though slowly, often imperfectly, and with apparent reluctance. He pays little attention to objects around him; and his countenance frequently has the apathetic, expressionless character of drunkenness, though sometimes wild and anxious. When told to protrude his tongue, he often does so partially and with apparent difficulty, and when it is protruded forgets to draw it in again. Delirium frequently replaces, or is mingled with the stupor. Sometimes it is violent, but much more frequently, low and muttering. Notwithstanding the heaviness of the patient, he gets little refreshing sleep, and often appears as if in a troubled dream. Now and then great restlessness and jactitation occur, with twitchings in various parts of the body.

Symptoms of debility are almost always mingled with those of perverted function. When consciousness remains, one of the most distressing sensations is that of utter prostration and powerlessness. The patient often feels as if he were sinking downward into the earth, with nothing underneath to support him, and no power of his own to check his descent. This has been described to me, after recovery, as a most horrible feeling, worse even than violent pain. A disposition to faint upon the slightest exertion is not uncommon, and fatal syncope sometimes occurs upon an attempt on the part of the patient to rise and walk. Even without any cause of this kind, sinking spells sometimes suddenly come on, in which life is in the greatest danger. Occasionally these follow immediately after long and profound sleep, which exhausts instead of refreshing the patient. Among the attendants upon this excessive debility is sometimes a sense of intense oppression at the chest, amounting almost to suffocation. The patient feels as if deprived of air, and labours painfully for breath, expanding the chest, and raising the shoulders as in an attack of violent pulmonary congestion.

Should no favourable change take place at this period, the disease passes into the last stage, or that of prostration. The patient lies upon his back in bed, with his eyes half closed and his mouth open, slipping downward from inability to maintain his position, and almost insensible to impressions from without. Along with stupor or low delirium, there are often subsultus tendinum, picking at the bed-clothes or at imaginary objects in the air, and sometimes spasmodic muscular movements amounting almost to convulsions. Occasionally the patient is troubled with hiccough. The pupil is sometimes dilated, sometimes extremely contracted. The tongue is often quite dry, the mouth loaded with brown or blackish sordes, and the breath offensive. Deglutition is often difficult from deficiency of muscular power. Occasionally involuntary discharges take place from the bowels or bladder, and sometimes the urine is suppressed. The surface has in great measure lost its sensibility, so that the strongest irritants make little impression; and I have heard of an instance in which a burning coal, applied to the epigastrium, gave rise only to an agreeable feeling. The extremities are cold; the skin pale; the features collapsed, and of an ashy hue. The pulse is sometimes frequent and fluttering, sometimes even slower than in health, but always small and feeble, and at length scarcely to be felt, or quite absent at the wrist.

Even in this state, however, the case is not desperate, and suitable remedies have often proved effective. But, should it terminate unfavourably, death usually approaches gradually, and without violence. The respiration becomes slower and slower, the pulse weaker and weaker, until, at length the patient ceases to breathe, and the heart to beat. In some rare instances, death is preceded by convulsions. When it takes place at an earlier period of the disease, it is more frequently violent, though even then it generally occurs through syncope, or in the midst of coma.

When the disease takes a favourable turn before the period of collapse, the event is generally indicated by a diminished frequency of pulse, a relaxed state of the skin, a return of moisture to the tongue with a disposition in its surface to clean, a gradual fading of the eruption, a subsidence of the nervous symptoms generally, and a return of consciousness. Not unfrequently convalescence is ushered in by some incident which may be considered as forming a crisis. Thus, a copious perspiration, or an unusual discharge of urine is followed by a marked amelioration of the symptoms; or the patient falls into a gentle and quiet sleep, and, upon awaking, is found to have recovered his consciousness, and to be in all respects improved. When recovery takes place from the state of collapse, it is usually by a gradual and almost imperceptible amendment, under the supporting influence of remedies. The force of the disease has been exhausted, and it is the extreme debility alone which is to be counteracted.

Convalescence is generally slow, as time is required not only for the subsidence of the morbid actions, but for the repair of the exhausted powers of the system. The hair is apt to fall, and the cuticle not unfrequently desquamates. The brain and nervous system generally are often long in regaining their previous energy; the intellect, and especially the memory, remaining imperfect for weeks or even months. In general, however, no ultimate inconvenience is experienced, and the restoration to health is perfect. Relapses are said sometimes to take place, but they are very rare. In the cases, however, connected with diarrhœa, this affection is apt to recur after convalescence, in consequence of premature or excessive indulgence of the appetite.* Recovery is also sometimes protracted by the occurrence of external abscesses, especially in the region of the parotids.

The *duration* of the disease is variable. When it terminates favourably, it generally runs a course of three weeks or more, occupying one week in the advance, another in the formed state, and a third in the decline. Sometimes, however, when very mild, it terminates as early as from the seventh to the eleventh day, and in other cases runs on for four weeks. Fatal cases may end at any period. Death sometimes occurs, without reaction, in the first twenty-four hours, and is not unfrequent so early as the fifth or sixth day. But more commonly it does not take place until some time in the second week, and is perhaps most frequent from the ninth to the twelfth day. It may also occur at a much later period.

Varieties.—These are such as arise from differences in degree, and from complications. Sometimes the disease is very mild, exhibiting only the ordinary symptoms of moderate fever, with some dulness or stupor, duskiness of complexion, and characteristic eruption, and terminating favourably without treatment. In other cases, it is exceedingly violent, the system sinking under the force of the first blow, and either never reacting, or but imperfectly. Such cases are now frequently called congestive. Their danger probably depends not on sanguineous congestion, but on the prostrating influence of the poison upon the nervous and circulatory systems. Between these extremes, there is every conceivable grade of violence.

In some instances, the disease is characterized by an early and peculiar tendency to dissolution of the blood. This is indicated by the passive hemorrhage attending them, the abundance and purple or livid colour of the petechiæ, the fetidness of the breath, the disposition to gangrenous eschars, and the extreme prostration of the pulse.

Another peculiarity is the absence, in certain cases, of all excitement of the pulse, and this without reference to the violence of the disease. Not only is the pulse unexcited, but it is even less frequent than in health, being sometimes not more than fifty in the minute.

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* A very interesting account is given by Dr. J. B. Upham, of Boston, of a secondary diarrhœa, which came on in the convalescence from typhus, as it occurred in the Deer Island Hospital, and which proved very fatal. Dissection disclosed discoloration and great thickening of the mucous membrane of the ileum, which exhibited prominent transverse parallel ridges, without special disease of the solitary or aggregated intestinal glands. (See *Bost. Med. and Surg. Journ.*, xxxvii. 16, 34, &c.)

The disease is very frequently associated with inflammation of some one or more of the organs, which considerably modifies its symptoms and result. The most common complication is probably with *pneumonia*, to which the mechanical congestion of the blood in the posterior portion of the lungs may give a peculiar tendency. For an account of the diagnostic symptoms of this affection the reader is referred to pneumonia. It may be inferred to exist when the patient coughs, and expectorates a rusty or bloody viscid matter; and the diagnosis would be confirmed by the absence of the respiratory murmur, the existence of a crepitant or subcrepitant rale, and dulness on percussion in the part affected. There is seldom much pain of the chest. This complication is most apt to exist in cold weather. In summer, the disease is more frequently associated with gastric, intestinal, or hepatic disorder. At that season, diarrhœa or dysentery sometimes occurs, in consequence of inflammation of the ileum and colon; and vomiting, epigastric tenderness, yellowness of the skin, &c., from gastritis and derangement of the liver. Inflammation of the fauces is also not unfrequent, and the disease is occasionally complicated with erysipelas. It is highly important that the practitioner should be aware of these inflammatory complications; as he might otherwise be apt to mistake the case for one of the ordinary phlegmasiæ, and treat it accordingly with fatal effect.

Other varieties of typhus fever are those which arise from its connexion with other fevers, dependent upon a simultaneous action of their cause with its own. Thus, it may be, and probably not unfrequently is associated with enteric or typhoid, and remittent or bilious fever.

Anatomical Characters.—Though various evidences of deranged structure are presented, upon dissection after death, in the advanced stages of typhus, yet there is no one characteristic and essential lesion, unless, perhaps, the state of the blood, and the petechial eruption. All the others may be considered incidental. In cases of early death, no lesion whatever is found to which the result can be attributed.

Blood drawn during life, in the earliest stage, forms a soft, large, sometimes dark-coloured coagulum, without the buffy coat. In consequence of the developement of inflammation, this appearance is sometimes presented at a later period. Blood drawn in the advanced stages is darker and more liquid, and, though it may still coagulate, does so more slowly, and forms a softer clot. Sometimes it is almost black. After death, it is found in the veins black, liquid, sometimes resembling molasses, and occasionally mixed with oily globules. When coagula are observed, which is rarely the case, they are very soft. From the experiments of Dr. Frick, it appears that the fibrin is generally below, and the red corpuscles above their normal proportion. (*Am. Journ. of Med. Sci.*, N. S., xv. 31.) MM. De Mussy and Rodier found the blood lighter than in health, the red corpuscles sometimes in normal proportion, sometimes considerably diminished, the fibrin either normal in quantity or diminished, and the serum remarkably diminished in density. (See *N. Y. Journ. of Med.*, N. S., xiii. 124.)

In general, a strong tendency to speedy putrefaction has been observed after death.

Within the cranium, there is often venous congestion, with some serous effusion in the ventricles or beneath the arachnoid, and the substance of the brain is occasionally darker than in health, though in other cases, unaltered, or even whiter. No clearly ascertained connexion exists between the stupor and the anatomical appearances of the brain.

The mucous membrane of the nostrils, fauces, and respiratory passages, is generally reddened. The posterior and lower portion of the lungs is often solidified, of a dark-red colour, fragile, and impervious to the air, though without the granular appearance of hepatization.

The gastric mucous membrane is often reddened, much softened, and sometimes mammillated; that of the intestinal canal is frequently free from disease, though sometimes found inflamed, and even ulcerated, in cases complicated with diarrhœa or dysentery. No disease whatever is observed in the glands of Peyer unless in a very few cases, which it is fair to ascribe to complication with enteric fever.*

The spleen is very often quite healthy, though frequently also softened, and sometimes enlarged. The liver is either healthy, or softened and engorged with blood. The heart is sometimes natural, sometimes softened. The bladder not unfrequently presents evidences of inflammation. (Macgreggor, *Lond. Med. Gaz.*, March, 1851, p. 411.)†

Causes.—The special causes of typhus fever are 1. the vitiated air resulting from the crowding of human beings in confined places, and 2. a peculiar contagion. The exhalations from the body and from the excretions probably undergo changes, resulting in the production of a poisonous aëriform matter, which, being absorbed into the system, gives rise to the disease in question. It is not necessary that the individuals who serve as the source of the poison should be diseased, though it is thought that certain complaints favour its production, such as dysentery, gangrene, &c. All that is absolutely essential is, that there should be numbers of persons crowded within confined and ill-ventilated places, in which the filth from the excretions is also allowed to accumulate. Hence, the disease has often made its appearance in camps, prisons, ships, hospitals, garrisoned cities, &c.; and hence, too, it is usually most prevalent among the lowest and most vicious people, inhabiting the cellars, lanes, and closely built parts of cities.

That, when once generated, the disease is capable of propagating itself by contagion is almost universally admitted. The facts in support of this opinion are too numerous and strong to be refuted. Thus, nurses and other attendants upon the sick are often seized with the complaint, without any other known cause. Armies are known frequently to have spread it in their march in places before healthy. Individuals attacked by it have been removed into uninfected neighbourhoods, and have there become centres of infection. It appears even to be capable of being conveyed in clothing, to which the poison has been said to adhere for the space of three months. Yet the contagion is not powerful. When unsupported by peculiarly favourable influences, the disease soon ceases to spread in healthy places. It is thought that the poison can act but a few feet from the point of emanation; and attendants upon the sick often escape, if great care is taken to ventilate the apartment, and observe perfect cleanliness. Of those exposed to it, moreover, a much larger proportion escape than in most other contagious diseases. It resembles these affections in seldom occurring twice in the same individual.

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* Diarrhœa has been a frequent complication in the typhus which has recently prevailed among the emigrants. In the genuine cases, the appearances of the bowels, on dissection, were as stated in the text. Among the cases of fever in the Pennsylvania Hospital in the winter of 1847–8, was one of great severity, in which there were diarrhœa and tympanites, but which, from the succession of symptoms, the character of the eruption, &c., was diagnosticated as typhus during life. On examination of this case after death, numerous gangrenous ulcers were found in the small intestines; but the solitary glands, the glands of Peyer, and the mesenteric glands were quite healthy. (*Note to the second edition.*)

† There is reason to believe that the deposition in various organs of a peculiar matter supposed to be characteristic of typhus fever, and therefore denominated *typhous matter*, belongs not to the fever now under consideration, the proper typhus, but to the enteric or typhoid fever, under which head the reader will find it referred to. (See *page* 337.)

Besides the causes above mentioned, epidemic influence undoubtedly sometimes produces the disease. I have no doubt whatever that the epidemics which caused such terrible ravages throughout a large portion of the United States, between the years 1807 and 1820, were of typhus fever; and it is well known frequently to occur in the same way in Europe, especially in Great Britain and Ireland. The other causes, too, are made much more effective by the co operation of an epidemic state of the atmosphere. It is only in this way that we can account for the production of the disease, on certain occasions, under circumstances apparently quite the same as those under which it is escaped upon others.

It may be a question whether all these causes are or are not identical. Considering the identical nature of the result, it would seem probable that the cause is the same; that is, that the aëriform poison, generated in crowded places, differs in nothing from that evolved by the bodies of the sick, and that produced, in some inexplicable manner, during epidemics. If we suppose the poison to be a form of invisible animal or vegetable life, we approach one step nearer to a solution of the difficulty.

Certain depressing agencies are capable of producing effects upon the system somewhat analogous to typhus. Unwholesome or insufficient food, long exposure to cold, the exhaustion of fatigue and excesses, continued anxiety, grief, fear, or other depressing emotion, nostalgia, and certain poisons, as sulphuretted hydrogen, and ergot in large quantities, are among the causes of this kind. There can be no doubt that these favour the action of the special cause. Hence, typhus fever is apt to follow in the march of famine. Hence, it is seldom or never completely eradicated from Ireland, where misery always serves to give activity to the germs which might otherwise lie hidden. But there is reason to doubt, whether mere depressing causes of a common nature can alone generate genuine typhus fever.

The disease is confined to no particular time of life. Age appears to exercise little other influence than as it may affect the healthy vigour of the individual. The complaint is less common in infancy than in middle or advanced life. The two sexes are equally liable to it under the same exposure. Negroes would seem to be more readily affected than whites. It is not certain that season is of any account. The disease has prevailed at all times of the year. If there is any difference in this respect, it is in favour of the winter. The intense cold of that season, acting upon a poorly clad and badly housed population, must predispose to it; and the necessity of living in confined apartments must favour the action of the cause. In this country, the disease has certainly in general shown a preference for the winter. It is much more common in the temperate and cold than in the hot latitudes, perhaps because dwellings are so much more open to the air in the latter.

The length of time which may intervene between the exposure and attack is uncertain. Cases are on record in which the disease appears to have been developed immediately; while in others several months are supposed to have elapsed. But such cases are always involved in some doubt. The period of incubation is generally from one to two weeks.

Nature.—Of the nature of typhus fever we know little. It is certainly one of those diseases which are most clearly independent of any local lesions. The probability is, that a poison is absorbed, which at once depresses the powers of the nervous system, and vitiates the blood. All the local congestions, and the low imperfect inflammations which attend the disease, are obviously secondary.

Diagnosis.—The most characteristic symptoms of typhus are, along with fever, prostration of strength; a dark-red or dusky hue of the countenance, with suffusion of the eyes; stupor; dark sordes about the tongue, teeth, &c.; constipation of the bowels in the earliest stage; the peculiar odour; the peculiar eruption; and the collapse of the last stage.

The disease with which it is most frequently confounded, and from which it is most important to distinguish it, is enteric or typhoid fever. The profession is much indebted to Dr. Gerhard, of Philadelphia, for the means of an accurate diagnosis. It was in the results obtained by the careful post-mortem examinations, made in the Philadelphia Hospital by that distinguished pathologist, in conjunction with Dr. Pennock, and their no less careful investigation of the symptoms during life, that we first obtained positive proof of an essential distinction between the two diseases, which Louis himself had previously been disposed to consider identical. Numerous and very careful observations subsequently made by Dr. W. Jenner, in the London Fever Hospital, fully coincide in their results with those of our own countrymen. The following are the most important points of difference.

Typhus fever less frequently commences insensibly than the enteric, and is, upon the average, of considerably shorter duration. Instead of the diarrhœa, or extraordinary susceptibility to the action of purgatives, which almost uniformly attends the latter disease, it is frequently accompanied with constipation; and, when fecal discharges are obtained, they are usually darker and more offensive. But hemorrhage from the bowels, which is not unfrequent in the advanced stages of enteric fever, seldom occurs in typhus. In the latter complaint, epistaxis at the commencement is less frequent; there is more stupor and a darker colour of the face, more turbidness of the conjunctiva, and much greater debility. The eruption in typhus also differs from that of enteric fever. It generally commences earlier; is not elevated as the other; is less regularly round or oval; is of a darker, more livid hue; does not so readily disappear under pressure, and is often unaffected by it; is much more abundant; does not appear in successive crops; and, instead of being confined chiefly to the abdomen and chest, is found equally upon the extremities, probably still more on the back, and is often diffused over almost the whole body. There is sometimes, however, in typhus, an eruption of light red spots, easily removed by pressure, and closely resembling those of enteric fever; but they are mingled with the other kind over all parts of the surface, and not limited to the anterior part of the trunk. (Dr. F. W. Sargent, *Am. J. of Med. Sci.*, N. S., xiv. 532.) In typhus fever the abdomen is often flat, and perfectly free from tympanites, which is almost never the case in the enteric. The signs of consolidation of the posterior part of the lungs are much more frequently present in the former, and the dry sibilant rales of bronchial inflammation in the latter. Enteric fever is of considerably longer duration than typhus. Dr. Jenner found the average duration of fatal cases of the former twenty-two days, of the latter fourteen. The urine, which, according to Mr. G. W. Edwards, is uniformly albuminous in the early stages of typhus, is so in the enteric only towards the close.

The anatomical characters of the two diseases are very different. The peculiar disease of the glands of Peyer, and of the mesenteric glands, so constantly present in enteric fever, is never found in typhus, or so seldom as to lead to the suspicion of some intermixture of diseases when it does occur. The spleen, too, is much less frequently enlarged and softened in the latter.

Dr. Jenner states that the spots which appear in typhus during life remain after death, while no traces of those of enteric fever are visible.

There are points of difference also in the persons attacked, and the circumstances under which the diseases originate. Thus, enteric fever almost never attacks the old, who are very frequent victims of typhus. The former disease is endemic in various countries, arises here and there (sporadically) without any obvious cause, and, if ever contagious, is very feebly and very rarely so; while typhus seldom occurs in isolated cases, is often long absent from countries where it occasionally prevails, is always contagious, and often epidemic.

Nevertheless, there are cases which cannot be clearly distinguished; and, as before suggested, it is highly probable that the two diseases now and then exist conjointly.

The other complaints with which typhus fever is most apt to be confounded are idiopathic fevers and the phlegmasiæ, when they take upon them a typhous character. But in these, the distinguishing traits of the several affections usually first make their appearance, and the typhoid symptoms come on in the course of the disease. The diagnosis is much aided, in all such cases, by our knowledge of the absence or presence of typhus, as a prevalent affection. If it do not prevail, the presumption is that the case in question is one only of simulated typhus.*

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* RELAPSING FEVER.—This is another peculiar disease, which, with the enteric and typhus fevers, has generally been classed in Great Britain, under *continued fever.* Though we have no certain proof of its existence in America, it will be proper to describe it briefly; as, if not here at present, it may readily be imported, and take root among our customary diseases.

The first known reference to it is contained in Rutty's *History of the Diseases of Dublin*, in which place it appears to have prevailed epidemically in 1739, and in several subsequent years. In 1817-18, it occurred at Edinburgh, and was described by Drs. Welsh and Christison. In the years 1842 and 1848, it again made its appearance in the same city; and it was through the published descriptions given of it, on this occasion, by Drs. Mackenzie, Cormack, Craigie, and others, that it came to be generally regarded as a distinct affection. In 1847, it appeared at London, where it was carefully examined by Dr. William Jenner, whose investigations have confirmed the conclusions of the Edinburgh physicians. There can be little doubt that it occurs also on the continent, as it has been recognized in the descriptions of various German writers. The probability is, that it is a not uncommon disease in Europe, but has escaped general notice from being confounded with other fevers. (For references to various authorities in relation to it, see the *British and Foreign Medico-Chirurgical Review* for July, 1851.) The name of *relapsing fever*, by which it will probably be known hereafter, was derived from one of its most striking peculiarities. It has also been called *five-day fever, seven-day fever, bilious remittent fever, mild yellow fever*, &c.

Symptoms, Course, &c.—Though sometimes preceded by the ordinary premonitory symptoms of fever, it more frequently begins abruptly, with coldness or rigors, headache, pains in the body and limbs, nausea and vomiting, and feelings of great weakness. After these come the usual phenomena of febrile reaction; a hot skin, thirst, frequent pulse, furred tongue, anorexia, &c.; attended with headache and severe pains in the muscles and joints, resembling those of rheumatism. Excessive nausea, retching, and vomiting are not unfrequent. Delirium is occasionally noticed, but is not an ordinary symptom. The patient is apt to be restless and wakeful. Epistaxis sometimes occurs. The abdomen is generally more or less tympanitic, and there is often tenderness on pressure over the liver, stomach, spleen, and bladder. The bowels are not usually disordered; but dysenteric symptoms occasionally appear towards the close. The patient, in some instances, complains of pain in passing his urine. Perspiration now and then occurs in the course of the disease, with some relaxation of the febrile phenomena. In many of the cases, particularly those of a grave character, the countenance has a peculiar light-bronze hue, which, on the third or fourth day, is followed by yellowness of various intensity, spreading over most of the surface. Though not always present, this is one of the characteristic features of the disease. The jaundice does not depend on

Prognosis.—The mortality in typhus varies exceedingly, according to the violence of the epidemic cause, and the circumstances under which the disease occurs. Certain epidemics are much more destructive than others; and in this, as in other diseases occurring epidemically, the cases which first appear are generally most fatal. In some instances, as large a proportion as one-half

obstruction of the gall ducts, which are quite free. It is often attended with vomiting of bile, hypochondriac or epigastric tenderness, deep-brown urine, and enlargement of the liver and spleen. In very bad cases, there is hemorrhage from the mucous membranes, black stools like those of melæna, and vomiting of a matter like the black vomit of yellow fever. At the height of the disease, convulsions sometimes occur; and pregnant women are very apt to miscarry.

When the symptoms have attained their greatest violence, and appear to threaten the most serious consequences, they often suddenly yield to a profuse perspiration, of an acid smell, which continues for several hours, sometimes even for a day or more, and leaves the patient almost free from disease, though, in bad cases, extremely weak. This event occurs sometimes so early as the third or fourth day, more frequently on the fifth, sixth, or seventh, and very rarely so late as the ninth. It is usually denominated the crisis. The patient now seems convalescent, and, in a few cases, the recovery is complete and permanent. But, in the great majority, at the end of about a week from the first appearance of amendment, or about two weeks from the commencement of the disease, a relapse takes place, in all respects similar to the first attack, sometimes being more severe, sometimes milder, and lasting usually four or five days. The pains are probably on the whole more distressing in this than in the first fever; and, if jaundice did not then appear, it is apt to appear now. Dr. Mackenzie states that the proportion of cases in which this relapse takes place is not less than nineteen out of twenty. Very generally, upon the subsidence of the second attack, the patient remains permanently well; but occasionally a third and even a fourth takes place, with similar intervals. Instead of going off with perspiration, the disease sometimes subsides without any striking phenomenon, or with an increased discharge from other emunctories. As a general rule, its duration may be stated at about three weeks.

Troublesome sequelæ sometimes occur, such as articular pains, muscular weakness, œdema of the feet, enlarged lymphatic glands, boils, inflammation of the eyes with amaurotic symptoms, and general chronic debility.

Upon dissection, redness of the mucous membrane of the bowels has been observed, but no special disease of the glands of Peyer. The spleen is very frequently enlarged.

Cause.—The cause is generally believed by British medical writers to be a peculiar contagion, which Dr. Jenner has shown not to be the contagion of the proper typhus fever. (*Medico-Chirurg. Trans.*, xxxiii. 23.) The disease, however, appears to occur epidemically, and is said to affect preferably persons living miserably, in crowded, filthy, and ill-ventilated situations.

Prognosis.—This is very favourable. Of persons previously in vigorous health, almost all recover. In different places, and by different writers, the average mortality has been variously stated at from two to nearly nine per cent. According to Dr. Mackenzie, scarcely any one died in the Edinburgh epidemic of 1842–3, except infants, the aged, and persons of broken constitutions.

Diagnosis.—The course and association of symptoms in this disease are different from those of any other known fever. It approaches the yellow fever most nearly, but differs prominently in its extreme actual mildness, compared with its apparent severity, and in the much longer duration both of the first fever and the intermission. With the enteric or typhus it could scarcely be confounded, if carefully watched throughout its whole course. It has neither the rose-coloured spots of the former, nor the measle-like eruption of the latter. Sometimes red spots, like fleabites, not removable upon compression, have been observed on different parts of the body, and sometimes also petechiæ. But neither of these is common. It differs entirely from both the above fevers in its course. The tendency to relapse, so characteristic of this, is wholly wanting in typhus; and in the enteric fever, if febrile symptoms recur sometimes during convalescence, they are obviously not a proper relapse, but the mere consequence of some local irritation, as of the bowels from over eating, or of the lungs from exposure to cold. Dr. Cormack gives, as the diagnostic symptoms of the disease, its *sudden invasion, the darkening of the face before and after seizure, the almost uniform occurrence of one or more relapses, the yellowness of the skin and occasional black vomit and hemorrhage, the brevity and mode of termination of the pyrexia, the severe muscular and articular pains, and the absence of the peculiar eruption of typhoid and typhus fevers.*

of the persons attacked have died. But this vastly exceeds the usual mortality. Perhaps the estimate of Drs. Barker and Cheyne, in relation to the Irish epidemic of 1817, 1818, and 1819, offers as near an approach to the true general average as can be attained. According to these authors, the general mortality was one in twenty-three.

The disease is less fatal in early, than in middle or advanced life. According to the reports of Dr. Gerhard (*Am. Journ. of Med. Sciences*, xix. 301), it is more apt to terminate unfavourably among the blacks than the whites. Previous debility, from whatever cause, whether disease, intemperance, excess of any kind, or old age, increases the danger.

The favourable signs have been already enumerated. The unfavourable are those indicating very great prostration, great alteration of the blood, or severe local disease. Among the first are an exceedingly feeble or an absent pulse, coldness and insensibility of the surface, a sudden fading of the eruption, and involuntary evacuations; among the second, abundant and dark-coloured petechiæ, copious hemorrhages, a very turbid conjunctiva, fetid breath, and a purple appearance of the extremities; among the third, violent delirium or profound coma, with a greatly expanded or greatly contracted pupil and stertorous breathing, indicating disease of the brain; and excessive labour in respiration or shortness of breath, indicating extensive consolidation of the lungs. Yet scarcely any condition is so desperate as to forbid all hope, and life has been preserved by a persevering application of remedies, even after apparent death.

Treatment.—In the earliest stage, before reaction has commenced, little treatment is usually necessary; and, indeed, there is seldom an opportunity for prescribing, as the patient is not seen until after the stage is passed. Sometimes, however, when it is more than ordinarily protracted or severe, it becomes necessary to employ remedies; and, during the prevalence of epidemics of typhus, cases now and then occur, in which life may depend upon the timely interference of the physician. An emetic has been recommended, under these circumstances, in order to rouse the system out of its apparent torpor, and to direct action to the surface. It may sometimes be useful when the depression is not great. Ipecacuanha or sulphate of zinc should be preferred. But the general indication is to stimulate by such means as will not be likely to increase the fever too greatly, when it takes place, nor too strongly to add to the already existing tendency to the brain. The morbid cause is depressing the vital functions by its sedative power; and there is danger that they may be reduced below the point of reaction. External stimulants are the safest. The most powerful rubefacients, such as mustard, solution of ammonia, Cayenne pepper, and oil of turpentine, should be applied to the extremities and along the spine; and these should be aided by external heat, by means of hot bricks, bottles of hot water, &c., placed along the body, hot stimulating pediluvia, or, what

Treatment.—This is very simple. The bowels should be kept open with mild cathartics, as castor oil; febrile heat should be allayed by the usual refrigerating methods; the irritation of stomach should be quieted by effervescing draughts, leeches, or revulsives to the epigastrium; or, upon the failure of these, by opiates administered either by the mouth or the rectum; and the headache should be counteracted by cold applications, and local bleeding if necessary. In the jaundiced cases, especially if attended with hepatic tenderness, the blue mass may be given, and suitable applications made to the right hypochondrium. Dysenteric symptoms are to be met by castor oil and laudanum. The Dover's powder may be given to control the general pains, when it can be retained by the stomach. Terebinthinate injections may be administered in the tympanitic cases. Debility is to be counteracted by wine, opium, sulphate of quinia, and nourishment. Attempts have been made to prevent the relapses by sulphate of quinia; but with doubtful success. (*Note to the third edition.*)

would probably be most effectual, the hot bath. If internal stimulation should become necessary, carbonate of ammonia, or oil of turpentine, would be preferable to the alcoholic remedies, as less likely to affect the brain; but, where the prostration is excessive, recourse may be had to wine, brandy, or even ether. Cases, however, requiring this treatment are extremely rare.

After the fever has become established, it may be proper, in cases of oppressed stomach, to unload that viscus by means of a mild emetic; but in general this may be dispensed with, and the treatment commenced with an efficient cathartic, so as thoroughly to evacuate the bowels. Calomel and rhubarb are generally best adapted to the circumstances of the case; though, when the febrile reaction is high, with considerable strength of pulse, the saline purgatives may be preferred, with or without the addition of senna. Throughout the whole course of the disease, the bowels, if there be a tendency to constipation, should be kept open by cathartics. These are indicated by the necessity which exists of avoiding accumulations of excreted matter in the bowels, and the depressing effects arising from its absorption when retained. The dark, offensive substances which collect in the alimentary canal in typhus, probably act as a direct sedative to the system. Cathartics, therefore, so far from increasing the debility, tend, if properly selected and employed, to obviate it. I am sure that I have seen the system, in low states of typhus, rise under the operation of medicines of this kind. No such contraindication exists here as in the enteric or typhoid fever. The only caution necessary is to graduate the activity of the medicine, its dose, and frequency of repetition, to the state of the system. In the early period of excitement, the object may be effected by small doses of some saline purgative; but later in the disease, rhubarb should be preferred, either alone, or combined with aloes. One of the tinctures of rhubarb may be employed, with great propriety, in the latest stage, when stimulation becomes necessary. Sometimes, it is advisable to aid the cathartic by enemata, which may in general advantageously contain the oil of turpentine.

The question as to the propriety of bleeding, in the early stage of the fever, has been much discussed. By some the remedy has been urged as of the greatest importance; by others it has been condemned as almost always injurious, and scarcely ever necessary. Probably the advocacy of it may have been partly owing to the confounding of this disease with enteric fever, which is known often to bear bleeding well at the commencement. It is very certain that, in genuine typhus, it is often capable of doing much harm; and death has frequently been the result of its injudicious use. During the prevalence of the great typhous epidemics of this country before alluded to, it frequently happened that, upon the first arrival of the disease in a neighbourhood, not being understood by the physicians, and frequently presenting the complication of some local inflammation, it was treated by them, as they had been in the habit of treating other febrile and inflammatory diseases, with the free use of the lancet. The consequences were in many instances very fatal. Such an instance occurred in the vicinity of Philadelphia. The disease approached the city through the State of New Jersey, and prevailed for some time in the opposite village of Camden, before it crossed the Delaware. In that place, it was not understood, and was treated as an inflammatory affection, with almost uniformly fatal results. The late Dr. Joseph Parrish, of Philadelphia, then a young practitioner, was called into the village at this juncture, and, having been prepared by the perusal of Dr. North's treatise on the disease as it had prevailed in New England, immediately adopted a different course of treatment, avoiding bleeding altogether, and using stimulants, with the effect of curing almost all the cases. He thus laid the foundation of that reputation as a skilful physician, which has never been exceeded in our city. So fatal was copious bleeding in that epidemic, that popular and to a great extent professional opinion received a set against it; and it was some time after the disappearance of all tendency to the disease, before the fear of the remedy so far subsided as to permit its judicious use, under circumstances requiring it.

But, though thus injurious if abused, there are undoubtedly cases of typhus fever in which bleeding may be moderately employed, with safety and advantage. It is highly probable that different epidemics may differ greatly in this respect; the loss of blood being much better borne in one than in another. The remedy is often very speedy and effectual in the relief of the headache, and other symptoms of cerebral disturbance, during the first few days. Its effects are said to be even more striking in this than in other febrile diseases. It may be resorted to when there is evidence of much and dangerous local determination of blood, with considerable strength of pulse. But even then, the quantity taken should be small. Little is required to diminish the force of the pulse, and there is danger of syncope, as well as of subsequent prostration from the loss of large quantities. Six or eight ounces are often sufficient, and more than twelve should seldom be abstracted at one operation. In the great majority of cases, venesection is altogether unnecessary. In those which are at all doubtful, it is best to employ local bleeding. This is safer, and relatively more effectual. When the head is affected, the blood should be taken from the temples, or back of the neck, by cups or leeches. In pectoral inflammation, they may be applied between the shoulders. A very slight depletion may sometimes be usefully effected by means of dry cups, which withdraw a certain amount of blood from the circulation to the surface where they are applied.

The febrile heat of the early stage is most effectually relieved by the external use of cold water. This may be dashed upon the patient, as recommended by Dr. Currie, or applied by sponging. The latter mode is preferable, when there is much debility. The remedy should never be used when there is any feeling of chilliness on the part of the patient, or any perspiration. Affusion would probably also be hazardous in cases complicated with pneumonia. In doubtful cases, sponging with warm water should be preferred. Sometimes spirit, or spirit diluted with water, may be advantageously substituted. The effect of these remedies is to relieve the distressing heat, relax the skin, produce occasionally a gentle sweat, and greatly comfort the patient. The affusion is said sometimes to have apparently arrested the disease.

The mild refrigerating diaphoretics may also be used, such as the neutral mixture, effervescing draught, solution of acetate of ammonia, and sweet spirit of nitre. British practitioners frequently employ the antimonials. Dover's powder is often very useful by producing diaphoresis, quieting restlessness, and promoting sleep. It should, of course, not be employed in comatose cases. When the fever is complicated with pectoral inflammation, no remedy is probably so effectual as a combination of opium, ipecacuanha, and calomel, given so as to keep the system moderately under an anodyne influence, and continued until it slightly affects the gums. Sometimes gently stimulant infusions may be administered at the same time. In this country, the infusion of serpentaria has been frequently used. On the continent of Europe, they often employ the flowers of arnica, and sometimes contrayerva and angelica.

Stimulants are essential in the treatment of typhus. Sometimes it is necessary to administer them from the outset of the disease; but more frequently they are required only at an advanced period, when the feebleness of the pulse, the commencing dryness of the tongue, the sordes about the teeth, and often some coolness of the extremities, indicate the commencement of prostration.

Upon the whole, the most efficient stimulants are Peruvian bark, wine, and opium. The bark was formerly given in decoction, often made with wine, with the addition of serpentaria, or aromatics. At present, sulphate of quinia is generally preferred as more convenient of administration, and more acceptable to the stomach. The dose may be a grain every two hours. Wine is usually given at first in the form of whey, made with two parts of boiling milk and one of Madeira, Sherry, or Teneriffe. Afterward, when stronger stimulation is required, it may be administered pure. The quantity must of course be regulated by the degree of debility, and the effects produced. It may not exceed a wineglassful in a day, or may amount to a quart. Porter or ale may be substituted, when more convenient, and preferred by the patient. Opium is administered in substance or tincture, in such quantities, and at such intervals, as to maintain a regular excitement, without stupefaction. From half a grain to a grain may be given every four, six, or eight hours; and the quantity may be increased if necessary. Carbonate of ammonia is also a good stimulant, which may often be used advantageously, dissolved in water with the addition of gum arabic and loaf sugar to obtund its acrimony. From two and a half to ten grains may be given at a dose every hour or two. It is customary to begin with small quantities of wine-whey and carbonate of ammonia, alternately, each every second hour; increasing the dose, and adding the other stimulants, as the case is found to require them. Sometimes it is necessary to have recourse to brandy, or other form of proof spirit. Milk punch is admirably adapted to many of these cases, combining nutriment in the best form with a powerful stimulant. The oil of turpentine may also be used; and some have recommended phosphorus; but I have never employed it.

Should the stimulants be found to increase the frequency of pulse, heat of skin, delirium, and stupor, they should be suspended, or the quantity reduced. If they strengthen without accelerating the pulse, relax the skin, and moderate delirium and stupor, they may be considered as doing good.

For the sudden sinking spells which sometimes occur, and threaten the most serious consequences, active stimulants must be quickly used. Under these circumstances, sulphuric ether may be given in the dose of a fluidrachm. Long continued sleep occasionally produces extreme exhaustion. It is best, therefore, unless sleep may from special causes be deemed very desirable, to wake the patient occasionally in order to administer his medicines. This too is necessary, in order to sustain a uniform remedial effect.

For the nervous symptoms, such as restlessness, jactitation, vague uneasiness, subsultus, &c., camphor is often an admirable remedy in doses of from five to ten grains, given in emulsion. Musk is the most effectual remedy in singultus.

External stimulation is important in those cases in which the surface is cool. This is effected by means of sinapisms to the extremities; blisters to the thighs and trunk, allowed to remain only so long as is necessary to redden without vesicating; and by frictions with Cayenne pepper and hot brandy, oil of turpentine, liniment of turpentine, &c. In the lowest and most insensible conditions, the electro-magnetic machine may be used; or the patient may be wrapped from head to foot in a blanket saturated with heated spirit, or, finally, the effect of a burning coal to the epigastrium may be tried.

For violent headache, coma, and delirium, after the local abstraction of a little blood, if this be deemed necessary, it will be proper to thin or shave off the hair, to apply ice or cold water, and in the latter stages to blister the back of the neck, or, what is preferable, the whole scalp. Sometimes great relief is afforded by warm fomentations about the head, when the cold applications fail.

For the measures requisite in cases complicated with inflammation of the lungs, the reader is referred to typhous pneumonia. Irritation of stomach and bowels is to be combatted by the ordinary measures, among which opiates internally, and revulsive applications or cataplasms externally, are not the least efficient. Dr. D. M. Reese, of New York, found great advantage in threatening cases of diarrhœa, from injections of a solution of nitrate of silver, containing a drachm of the nitrate in a pint of water. (*New York Journ. of Med.*, ix. 270.)

The remarks made in reference to diet, under enteric fever, are applicable also here. It is even more necessary in typhus to throw a due amount of nutriment into the system; and, though for the first few days, it may be proper to confine the patient to farinaceous liquids, yet, as the disease advances, animal broths become necessary, and in very feeble states we must have recourse to the animal essences, egg-nog, milk punch, &c.

Though Peruvian bark, in various forms of preparation, has long been used in the treatment of typhus fever, it has generally been given in moderate doses, and with reference to its tonic or supporting effect. But, in the form of sulphate of quinia, it has recently been very highly recommended by Dr. Robert Dundas, of Liverpool, in large doses, in the early stages of the disease, with reference to an immediate curative effect; and, from his own statements, as well as those of several others who have adopted the practice, there is reason to believe that it often very much shortens the duration of the complaint. According to Mr. J. O. Fletcher, who has employed this treatment very largely, and has found it very successful, it is applicable only to the pure cases of typhus, and not to those complicated with ulcerated bowels, pneumonia, or cerebral congestion. The sulphate is given in doses of from three to ten grains every two or three hours. It may be given at any stage, unless there should be great prostration. Milk and soup are to be given freely, and wine or brandy in the advanced stages, or in cases of drunkards. (*Lond. Med. Times and Gaz.*, vi. 422.)

Prevention.—There are few diseases in which more can be effected in the way of prevention than this. Thorough ventilation; perfect cleanliness in clothing, person, and apartments; a wholesome and nutritious diet; and sufficient protection against cold, will go far towards securing impunity to individuals necessarily exposed in some degree to the cause of the disease. Persons not called upon by duty to attend the sick should avoid their presence. They who are compelled to enter within the sphere of infection should not do so on an empty stomach; they should avoid inhaling the breath of the patient, or the air in the very near vicinity of his surface; they should not swallow their saliva; and, on leaving the apartment, should wash their hands and face, and change their outer clothing.

The apartment of the sick should be well aired; everything offensive should be removed without delay; the bed and body-linen of the patient should be frequently changed; and care should be taken that as few persons as possible should remain in the room. In hospitals, prisons, &c., it is of great importance to distribute the patients over as great a space as possible.

Something may also be done by chemical means to change the character of the contaminated air. For this purpose, chlorine is the most effectual agent. A thorough fumigation with the gas should be employed when it is possible to obtain the apartment free from tenants; and, even while it is occupied by the patients, solutions of chloride of lime or soda may be exposed in it, the wood-work of the room and the bedstead may be washed with them, the floor sprinkled with them, and they may even be added to the water used in the sponging of the patient.

twice in twenty-four hours, the remission in the morning and towards
g, the exacerbation in the middle of the day and night. The morning
ion and nocturnal exacerbation are commonly the greatest. Sometimes
atement of symptoms in the remission is so considerable as to resemble
escence. The subsidence of the febrile excitement is often attended with
ration; and when this is considerable on the third or fifth day, it is re-
as favourable. From that time the exacerbations return with dimi-
violence, and there is a gradual amendment, though the disease may
ne for a week or two longer before convalescence is established. In the
time, the buboes and carbuncles have been going through their regular
, leaving abscesses or ulcers, which heal in a shorter or longer time.

atal cases, the symptoms above enumerated assume their gravest cha-
; the pulse sinks; blood oozes from the mucous surfaces; petechiæ or
appear upon the skin; the surface becomes cold and clammy; trem-
of the tongue, subsultus tendinum, and coma or low delirium indicate
ltering state of the nervous system; and death occurs, either without
le, or preceded by delirious movements or convulsions. In cases of this
he buboes appear late, and do not advance to suppuration. Sometimes
lisappear altogether. Death usually takes place in five or six days,
the case is sometimes protracted for a fortnight or longer.

there are many variations from the above routine of symptoms. In
nt instances, the disease is extremely mild, even without fever, and the
t walks about, complaining of nothing but buboes in the groin or axilla,
onfined to bed, is so only in consequence of the pain produced in walk-
the local affection. In other instances, there is more or less fever with
boes, and occasionally slight carbuncles, but without malignant symp-
and the attack terminates favourably in about two weeks.

the other hand, many exceedingly malignant cases occur, in which a
low appears to be given at the very commencement. In some of these,
re symptoms of great nervous disorder, and universal prostration, which
death in less than twenty-four hours, without the developement of buboes
uncles, and without any signs of reaction. Occasionally a partial reac-
kes place, with symptoms of fever; but the malignant phenomena, such
been already noticed as attending the last stage of ordinary violent
greatly predominate. There may even be deceptive remissions; but
re soon followed by a return of the worst symptoms. Buboes and car-
may be formed; but the former do not advance to suppuration, nor
ter to the separation of the slough. Petechiæ and vibices are not un-
n. Death takes places usually before the expiration of the third day,
ldom so late as the fifth. Cases of the kind here described occur most
ntly at the beginning of an epidemic, and are almost always fatal.
mes the patient dies suddenly, without any preliminary appreciable dis-
A few words upon buboes, carbuncles, and petechiæ, will close the
matology of the disease.

oes are swellings of the lymphatic glands. They may show themselves
at the commencement of the disease, after the expiration of one or
ays, or not until near the close; and they are sometimes absent in bad
Their most frequent situation is upon the upper and inner part of the
or in the groin. They also occur in the neck at the angle of the jaw,
the axilla. The swelling may be confined to one gland, or may extend
ral. The first sign of the affection is usually a shooting pain in the
hich precedes the tumefaction. In the beginning there is no discolora-
the skin. The tumour is sometimes movable, but frequently adheres
tissues beneath, especially in the more serious cases. In favourable

isolation of large bodies of people has secured to them an entire or almost entire exemption, while the disease was raging around them; and positive proof appears to exist, that the disease has been communicated, through individuals or fomites, from an infected to a healthy neighbourhood. Persons exposed to the cause of the disease, in a sickly district, have removed to a distant and healthy place, and have there died of the plague; and shortly afterwards, numerous individuals of their own particular family have become affected. Besides, the almost universal opinion of the communities in which the disease prevails should be allowed some weight; as also should the fact, that the Franks in the Levant, who take precautions against contagion, are much less frequently affected than the Turks, who are practical predestinarians, and use no precaution. Inoculation with the pus of plague buboes has in some instances been followed by the disease, in others not. No positive inference can be deduced from this fact; for, as the operation was performed in infected neighbourhoods, the disease might have arisen from other causes. It would appear that certain individuals are insusceptible of the contagious influence under all circumstances; for of those exposed to it in the highest degree, during the prevalence of the disease, many escape. It would appear also that the susceptibility of persons generally is much less under certain circumstances than under others; otherwise, the sporadic cases which are asserted to be always in existence, would be constantly acting as the centres of new infections. But these are no arguments against contagion altogether; for we find the same exactly to be the case with scarlet fever, and to a considerable extent with measles, both of which are contagious. It is generally supposed that the contagion may not only be imparted from individual to individual; but that it may be conveyed by means of clothing or articles of merchandise from place to place; though some, who even admit personal contagion, deny the latter mode of communication. Difference of opinion has also existed as to the necessity of actual contact; some supposing that the poison is communicated, like that of syphilis, only by the touch, others that it may be exhaled in the aëriform state from the body, and, like that of other contagious fevers, act through the medium of the atmosphere. Analogy is in favour of the latter opinion.

But, though contagion must be admitted to be a cause of plague, it is, I think, certainly not the only, or even the chief cause. There must be some other influence, acting sometimes in the production of sporadic cases, which can be traced to no particular origin, and sometimes, when from unknown causes increased in intensity and diffusion, producing a wide prevalence of the disease, having all the characters of an epidemic. What is the nature of this influence, or what its origin, has never been ascertained. Some have supposed that it is connected with effluvia from the filthy accumulations, and foul excretions of a crowded and uncleanly population; but this opinion is met at once by the unanswerable argument, that such effluvia exist elsewhere, and under apparently the same circumstances, without producing the effect. Still, they certainly appear to favour the propagation of the disease; and there is some reason to think that the recent exemption of many places formerly afflicted with it, may be owing to their greater cleanliness and better ventilation. But there is something more; and what that is remains to be determined. The idea of an origin in microscopic organic beings must suggest itself to every inquirer; but it is yet too little supported by facts to be considered in any other light than that of pure hypothesis.

The epidemic prevalence of plague is evinced by the following facts. The disease appears at certain periods after a more or less complete exemption, affects at first a few individuals scattered in different spots and without personal communication, rapidly increases until immense masses of the population

Article VI.

PLAGUE.

Syn.—Pestis.

Plague is a febrile disease characterized by buboes or swellings of the lymphatic glands, by carbuncles, and petechiæ. As it does not appear upon this continent, and the author has never seen a case of it, a brief summary only of the more prominent facts in relation to it, as stated by eye-witnesses, will be given in the present work.

The true home of the disease, where it prevails now, and has probably prevailed from the earliest periods of history, is in the regions bordering upon the eastern extremity of the Mediterranean and its tributaries. In the middle ages, and so late even as the sixteenth and seventeenth centuries, it occasionally visited western Europe, and was well known in Italy, France, England, and Germany. London and Paris suffered from it greatly in former times. But, for more than a century, the plague has been almost unknown in the west of Europe; the last remarkable visitation having been in 1720, when Marseilles lost with it nearly one-half of her population. It is now limited chiefly to Egypt, Syria, Anatolia, Greece, and European Turkey; occasionally extending northward into Russia, and westward as far as Malta.

Symptoms, Course, &c.—The disease usually makes its appearance, without premonition, with the ordinary symptoms of fever, such as chilliness, feelings of weariness, languor, or debility, precordial uneasiness, occasionally nausea and vomiting, headache, vertigo, a hot and dry skin, and a frequent pulse. Darting pains are felt in the groins, arm-pits, or other parts of the body, which are soon followed by enlargement of one or more of the lymphatic glands, or by inflammation of the subcutaneous tissue constituting carbuncles. As the disease advances, the swellings usually go on increasing, while various symptoms more or less alarming are rapidly developed. The tongue, at first somewhat swollen, moist, and covered with a white fur, before the close of the disease, often becomes dry, brown or blackish, and sometimes fissured; while a dark sordes collects upon the gums, teeth, and lips. There is often extreme thirst, and a sensation of burning heat internally. Severe pain is felt in the præcordia, with nausea and frequent vomiting; the matters discharged being whitish or blackish, and sometimes bloody. The bowels are usually constipated in the beginning; but in the end often become relaxed, with dark and offensive stools. The breathing is hurried or laboured; and the pulse variously affected, generally accelerated, sometimes full and strong, though more frequently feeble, occasionally nearly natural, and in bad cases irregular or intermittent. The urine, in some instances nearly healthy, is in others scanty, turbid, yellowish or blackish, and tinged with blood. Occasionally, moderate perspirations of a favourable character appear, while at other times they are copious and exhausting. The general strength is greatly prostrated; the patient, if he attempts to walk, has a staggering gait; and attacks approaching to syncope are not uncommon. The eyes are red and turbid, the face flushed or even livid, and the expression of countenance often like that of a drunken man. The patient is confused in mind, delirious, stupid, or comatose; or extremely restless, agitated, and alarmed; and often stammers when attempting to speak.

The symptoms are not of uniform violence through the day. As in most other febrile diseases, there are remissions and exacerbations, which usually occur twice in twenty-four hours, the remission in the morning and towards evening, the exacerbation in the middle of the day and night. The morning remission and nocturnal exacerbation are commonly the greatest. Sometimes the abatement of symptoms in the remission is so considerable as to resemble convalescence. The subsidence of the febrile excitement is often attended with perspiration; and when this is considerable on the third or fifth day, it is regarded as favourable. From that time the exacerbations return with diminished violence, and there is a gradual amendment, though the disease may continue for a week or two longer before convalescence is established. In the mean time, the buboes and carbuncles have been going through their regular course, leaving abscesses or ulcers, which heal in a shorter or longer time.

In fatal cases, the symptoms above enumerated assume their gravest character; the pulse sinks; blood oozes from the mucous surfaces; petechiæ or vibices appear upon the skin; the surface becomes cold and clammy; trembling of the tongue, subsultus tendinum, and coma or low delirium indicate the faltering state of the nervous system; and death occurs, either without struggle, or preceded by delirious movements or convulsions. In cases of this kind, the buboes appear late, and do not advance to suppuration. Sometimes they disappear altogether. Death usually takes place in five or six days, though the case is sometimes protracted for a fortnight or longer.

But there are many variations from the above routine of symptoms. In frequent instances, the disease is extremely mild, even without fever, and the patient walks about, complaining of nothing but buboes in the groin or axilla, or, if confined to bed, is so only in consequence of the pain produced in walking by the local affection. In other instances, there is more or less fever with the buboes, and occasionally slight carbuncles, but without malignant symptoms; and the attack terminates favourably in about two weeks.

On the other hand, many exceedingly malignant cases occur, in which a fatal blow appears to be given at the very commencement. In some of these, there are symptoms of great nervous disorder, and universal prostration, which end in death in less than twenty-four hours, without the developement of buboes or carbuncles, and without any signs of reaction. Occasionally a partial reaction takes place, with symptoms of fever; but the malignant phenomena, such as have been already noticed as attending the last stage of ordinary violent cases, greatly predominate. There may even be deceptive remissions; but they are soon followed by a return of the worst symptoms. Buboes and carbuncles may be formed; but the former do not advance to suppuration, nor the latter to the separation of the slough. Petechiæ and vibices are not uncommon. Death takes places usually before the expiration of the third day, and seldom so late as the fifth. Cases of the kind here described occur most frequently at the beginning of an epidemic, and are almost always fatal. Sometimes the patient dies suddenly, without any preliminary appreciable disorder. A few words upon buboes, carbuncles, and petechiæ, will close the symptomatology of the disease.

Buboes are swellings of the lymphatic glands. They may show themselves either at the commencement of the disease, after the expiration of one or more days, or not until near the close; and they are sometimes absent in bad cases. Their most frequent situation is upon the upper and inner part of the thigh, or in the groin. They also occur in the neck at the angle of the jaw, and in the axilla. The swelling may be confined to one gland, or may extend to several. The first sign of the affection is usually a shooting pain in the part, which precedes the tumefaction. In the beginning there is no discoloration of the skin. The tumour is sometimes movable, but frequently adheres to the tissues beneath, especially in the more serious cases. In favourable cases, it gradually enlarges, suppurates, and in two or three weeks opens, and discharges pus; after which the abscess slowly heals, leaving a permanent scar. Sometimes the buboes disappear without suppuration. Tumours resembling buboes occasionally form in the subcutaneous tissue; and secondary buboes may result from the propagation of irritation from a carbuncle along the absorbents to the lymphatic glands.

Carbuncles usually make their appearance later than the buboes, and may occur upon any part of the body, as the neck, back, chest, extremities, face, and even scalp. Sometimes there is only one or a few, sometimes they are very numerous, and not unfrequently they are quite wanting. They begin with a vesicle of a yellowish, purplish, or blackish colour, usually upon a reddish base. This breaks and is followed by a gangrenous spot, which extends, and forms a dark crust, sometimes two or three inches in diameter. In favourable cases, this is attended with inflammation of the adjacent parts, which produces ulceration, and the separation of the slough, leaving a sore of larger or smaller dimensions. Considerable destruction of parts thus sometimes takes place. In bad cases, the gangrenous part is apt to remain dry and adherent.

Petechiæ are red or purplish spots like fleabites, which usually become livid as the disease advances. They are often wanting, and occur only in bad cases. Sometimes, along with these spots, are irregular purplish or livid patches like bruises, or long stripes called vibices; and cases occur in which the whole surface of the body has a mottled appearance. These discolorations are owing to the extravasation of blood; and occasionally ecchymoses or collections of effused blood form in the cellular tissue.

Anatomical Characters.—The blood is generally coagulable, but more slowly and feebly than in health; and the serum floating above the clot is reddened by the disintegrated corpuscles. In some instances, the blood will not coagulate, and is then surmounted by floating drops of oil. (*Bulard.*) It is usually denser than in health, of a dark colour not brightening on exposure, and sometimes of a peculiar odour. The inflammatory crust does not appear when it coagulates. After death, black coagula are found in the ventricles, aorta, and vena cava.

Upon dissection, black spots of extravasation are observed through the viscera, as the heart, lungs, stomach and bowels, liver, &c., and even in the neurilema of the nerves. The parenchyma of the solid viscera is generally engorged with black fluid blood; and hemorrhagic effusion often exists in the cellular tissue about the kidneys, and in the pelvis. One or more lymphatic glands are found enlarged, and engorged with blood, even when no bubo was observable during life. The spleen is enlarged and softened. Signs of inflammation are found in various parts of the body in protracted cases.

Cause.—Great difference of opinion has existed, and still exists, in relation to the cause of plague. Some maintain that it is propagated exclusively by a peculiar contagion; others, while admitting its contagious nature, believe that it often occurs endemically or epidemically; and a third party reject the notion of contagion altogether, asserting that the disease originates exclusively either in local causes or epidemic influence.

In order to come to any conclusion upon these points, it is necessary to recollect that sporadic cases of the disease are asserted to be existing at all times, in certain places, especially in Egypt; that, at certain seasons, the disease rages more severely in these situations; and that, in other places, it occurs only occasionally, and at longer or shorter intervals, the inhabitants being perfectly exempt from the disease in the mean time.

It appears to me impossible to resist the testimony adduced in favour of the doctrine of contagion. Numerous instances are on record, in which a perfect isolation of large bodies of people has secured to them an entire or almost entire exemption, while the disease was raging around them; and positive proof appears to exist, that the disease has been communicated, through individuals or fomites, from an infected to a healthy neighbourhood. Persons exposed to the cause of the disease, in a sickly district, have removed to a distant and healthy place, and have there died of the plague; and shortly afterwards, numerous individuals of their own particular family have become affected. Besides, the almost universal opinion of the communities in which the disease prevails should be allowed some weight; as also should the fact, that the Franks in the Levant, who take precautions against contagion, are much less frequently affected than the Turks, who are practical predestinarians, and use no precaution. Inoculation with the pus of plague buboes has in some instances been followed by the disease, in others not. No positive inference can be deduced from this fact; for, as the operation was performed in infected neighbourhoods, the disease might have arisen from other causes. It would appear that certain individuals are insusceptible of the contagious influence under all circumstances; for of those exposed to it in the highest degree, during the prevalence of the disease, many escape. It would appear also that the susceptibility of persons generally is much less under certain circumstances than under others; otherwise, the sporadic cases which are asserted to be always in existence, would be constantly acting as the centres of new infections. But these are no arguments against contagion altogether; for we find the same exactly to be the case with scarlet fever, and to a considerable extent with measles, both of which are contagious. It is generally supposed that the contagion may not only be imparted from individual to individual; but that it may be conveyed by means of clothing or articles of merchandise from place to place; though some, who even admit personal contagion, deny the latter mode of communication. Difference of opinion has also existed as to the necessity of actual contact; some supposing that the poison is communicated, like that of syphilis, only by the touch, others that it may be exhaled in the aëriform state from the body, and, like that of other contagious fevers, act through the medium of the atmosphere. Analogy is in favour of the latter opinion.

But, though contagion must be admitted to be a cause of plague, it is, I think, certainly not the only, or even the chief cause. There must be some other influence, acting sometimes in the production of sporadic cases, which can be traced to no particular origin, and sometimes, when from unknown causes increased in intensity and diffusion, producing a wide prevalence of the disease, having all the characters of an epidemic. What is the nature of this influence, or what its origin, has never been ascertained. Some have supposed that it is connected with effluvia from the filthy accumulations, and foul excretions of a crowded and uncleanly population; but this opinion is met at once by the unanswerable argument, that such effluvia exist elsewhere, and under apparently the same circumstances, without producing the effect. Still, they certainly appear to favour the propagation of the disease; and there is some reason to think that the recent exemption of many places formerly afflicted with it, may be owing to their greater cleanliness and better ventilation. But there is something more; and what that is remains to be determined. The idea of an origin in microscopic organic beings must suggest itself to every inquirer; but it is yet too little supported by facts to be considered in any other light than that of pure hypothesis.

The epidemic prevalence of plague is evinced by the following facts. The disease appears at certain periods after a more or less complete exemption, affects at first a few individuals scattered in different spots and without personal communication, rapidly increases until immense masses of the population are affected, then gradually declines, and at length ceases altogether, after a duration of three or four months. As in other malignant epidemics, the first cases are usually very severe and generally fatal; those at the close are often very mild; and those in the middle period, of an intermediate degree of intensity. Nor is the disease usually confined to one city. A number of different places within certain limits are often affected simultaneously, without any communication, or so nearly at the same time, that the disease could not have been conveyed from one to the other by human agency. During the prevalence of the disease, other low or malignant affections are apt to occur, showing some general distemperature of the air; and it is even asserted that the lower animals suffer. Temperature appears to have some influence over the morbific cause. It is thought that excessive heat, and intense cold, are both opposed to it. According to Sir Gilbert Blane, the disease cannot exist when the temperature is above 80° F., or a little below 60°. Hence, when it prevails during the spring in the Levant, it ceases in the summer; and when during the latter part of summer or the beginning of autumn in colder latitudes, it is arrested by the approach of winter.

Besides the essential or specific cause of the disease, there are circumstances which produce a peculiar predisposition to it, and others, which appear to act as exciting causes. These, however, are similar to those already mentioned as producing a like effect in other diseases, having like this a specific cause. (See *Yellow Fever*, page 318.)

Nature.—This is yet unknown. The probability, however, is, that a poison is absorbed, and alters at once the nature of the blood, and the condition of the tissues.

Diagnosis.—When buboes, or carbuncles, or both appear, there can be little difficulty in distinguishing cases of plague. Without these characteristic phenomena, it can be decided with certainty that any given case is plague, only by its occurrence at the commencement, or in the midst of an epidemic prevalence of the disease.

Prognosis.—This is an exceedingly fatal disease, not only in relation to the proportion of the sick who die, but of the whole population who are affected. Thus, it is estimated that in Marseilles, during the plague of 1720, out of a population of 90,000, the number of cases was 80,000 and of deaths 40,000; and in Moscow, in the year 1770–71, nearly if not quite one-half of the inhabitants are thought to have perished.

In individual cases, the unfavourable symptoms are great general depression at the beginning, a tendency to syncope, a natural or intermittent pulse with other unequivocal signs of a violent attack, the absence of buboes, the conjoint appearance of carbuncles and petechiæ, and all the symptoms which generally characterize great malignancy, such as a drunken expression of countenance, muddiness of the conjunctiva, coma or low delirium, stammering, excessive oppression of breath, severe precordial pains and vomiting, hemorrhages of dark blood, hiccough, black tongue, fetid breath, &c. Favourable signs are the occurrence of buboes without fever, the early appearance and regular progress of buboes, the eruption of carbuncles with broad inflamed bases, open and well-developed febrile action, moderate perspiration at the commencement of the remissions, and, generally, the absence of the symptoms above enumerated as of bad augury.

Treatment.—Various plans of treatment have been employed, but all with such doubtful success, that the practitioner is thrown upon his general principles. There is no specific for the plague. Emetics are recommended at commencement of the disease by many practitioners. There is also a common consent in the propriety of employing a brisk cathartic, to be followed by means calculated to keep the bowels regularly open during the continuance of the disease. Much difference of opinion exists as to the propriety of bleeding, some recommending this remedy, and others considering it not only useless, but positively injurious. The probability is, that, as in other febrile diseases, it may be admissible in some cases, while in others it is entirely contraindicated. It should never be employed unless when the pulse is strong, and some local injury is threatened from excess of vascular action. M. Aubert, who began by employing depletory measures freely, ended by abandoning them altogether. Cold ablutions or affusions, and the use of the refrigerant saline diaphoretics, with spirit of nitric ether, are advised during the existence of fever with a hot dry skin. Cold acidulated drinks, such as lemonade, may be employed under the same circumstances. The Dover's powder may be substituted for the saline diaphoretics, when the pulse is feeble, and the nervous system disordered. Mercury, in reference to its constitutional impression, has been tried, but with no great success. Friction with olive oil was at one time highly lauded; but experience has not confirmed the first reports in its favour. In low cases, it is necessary to resort to tonics and diffusible stimulants. The local treatment is confined, by the best practitioners, to the use of emollient poultices to the buboes and carbuncles, and gently stimulant applications to the ulcers which follow them. Fetor may be corrected by washes of solution of chloride of lime. Cauterisation of the buboes and carbuncles has been recommended by some, but is of doubtful efficacy.

Prevention.—Much may no doubt be done by care, towards guarding against the attacks of the malady. It is only upon this ground, that we can explain the comparative exemption of European residents in the infected cities of the Levant. Frequent ablution with cold water, perfect cleanliness in clothing, moderation in eating, drinking, and the pursuit of pleasure, ventilation, and the avoidance of crowded and filthy places, are important measures. Ventilation may be in some measure secured by making fires in the houses; and infected air may perhaps be purified by means of chlorine. But no means are so effective as removal from the limits within which the cause is acting. Whatever may be our speculative opinion in relation to contagion, a prudent caution would induce avoidance of all unnecessary communication with the sick, or contact with fomites which might have become infected with the poison. Bathing the skin with olive oil has been recommended very strongly as a prophylactic. Bleeding, purging, and low diet, employed for the same purpose, can have only an injurious effect. Inoculation has been tried, but with no favourable result.

Article VII.

SMALLPOX, or VARIOLA.

This is a contagious disease, characterized by an initial fever of three or four days' duration, succeeded by an eruption which passes through the different stages of pimple, vesicle, and pustule, and arrives at maturity in about eight days.

There is no proof that smallpox was known to the ancient Greeks or Romans. It appears to have prevailed in India and China from time immemorial. Europe first became acquainted with it through the Arabians. It is said to have first shown itself in Arabia about the time of the birth of Mohammed, and to have invaded Syria, Egypt, and Southern Europe, with the armies of his successors.

Two prominent varieties of the disease have been recognized by most writers upon the subject; the *distinct* and the *confluent*; the former characterized by the isolation of the pustules, the latter by their coalescence. There are, besides, numerous complications and modifications of the disease, which merit attention. Most of the latter may be included under the title of *varioloid*.

All cases of regular smallpox have three stages: 1. of the initial or eruptive fever; 2. of the progress and maturation of the eruption; and 3. of the decline. Some treat of the period of incubation, or that which intervenes between the reception of the poison into the system and the attack of fever, as the first stage of the disease; but it is clearly no stage at all; for the disease has not yet begun. Some uncertain feelings of disorder, such as often usher in febrile affections, may occasionally precede the attack of smallpox; but they are too slight, and too frequently quite wanting, to be considered as an essential part of the complaint.

Symptoms, Course, &c.

1. DISTINCT SMALLPOX.—The *first stage* commences usually with rigors of various intensity and duration, which are followed by heat of skin, acceleration of the pulse, furred tongue, loss of appetite, thirst, epigastric uneasiness, often nausea and vomiting, headache, pains in the back and limbs, and general muscular weakness. These are the ordinary symptoms of fever, and there is nothing, in this stage of smallpox, to distinguish it with certainty from other febrile affections. If there is anything peculiar, it is in the violence of the pains in the small of the back, and the frequent occurrence of obstinate vomiting, which cannot be referred to gastric inflammation or cerebral disease, and which often resists all the remedies that can be applied. There are various other occasional symptoms. A tendency to perspiration is sometimes observable. Soreness of throat, coryza, sneezing, and an excess of tears, are not uncommon. Active delirium sometimes occurs, with a flushed face, swollen features, and sparkling eyes. Some cases are attended with stupor, while in others the patient is wakeful, uneasy, and restless, or is affected with oppression in breathing, and occasionally with severe pains in the chest. In children, the disease is not unfrequently ushered in with convulsions, which sometimes, though rarely, occur also in adults. The fever is often decidedly remittent, with daily exacerbations. It usually continues for three or four days, and then subsides upon the occurrence of the eruption. This generally commences in the course of the third day, though often so slight at first that it is not immediately observed. Minute bright red specks show themselves upon the face, soon afterwards upon the neck, upper part of the breast, and forearms, and at last upon all parts of the trunk and lower extremities. Sometimes, though very rarely, they appear first upon the limbs or trunk. The eruption is generally completed by the end of the fourth or beginning of the fifth day, at which time the fever has entirely disappeared. The subsidence of the fever is often rapid and even abrupt. At one visit, the patient is seen with headache, a hot skin, a frequent pulse, and perhaps vomiting; and at the next is found cool and comfortable, with a natural pulse and a retentive stomach, and, except for the eruption, which has shown itself in the mean time, apparently convalescent.

The *second stage* may be considered as commencing when the eruption is fully out. In the alterations which this undergoes in different parts of the body, it follows an order corresponding with that of its coming forth, first changing upon the face, then on the trunk and arms, and lastly on the lower extremities. Scarcely prominent in the beginning, it very soon becomes observably papular, and, upon the second or third day, a little clear lymph may be seen at the apex of each pimple, which has, therefore, been converted into a vesicle. On the third or fourth day, the pocks are distinctly formed, being round, and flattened on the top, in the centre of which is often a little depression, giving to the eruption a characteristic umbilicated appearance. They are now hard to the touch, and are generally surrounded by an inflamed areola, which renders the skin red between them. From this period, they gradually increase in size, and change from vesicles into pustules; their liquid contents becoming more and more opaque, until at length quite purulent. As they approach their completion, they lose the umbilicated form, and become convex and apparently distended at top. Those upon the face are generally at the height, and begin to turn, on the eighth day of the eruption, the eleventh or twelfth of the disease; but it is two or three days later, and sometimes still longer, before those upon the feet have attained maturity. The process by which the vesicles are changed into pustules is called their maturation.

The quantity of the eruption is very different in different cases. Sometimes the pustules are very few, sometimes so numerous as to cover almost the whole body, in such a manner, however, as to be quite isolated.

Various interesting incidents occur in the progress of the eruption. Patients often complain of tingling or itching, and the skin is more or less tender. An eruption also takes place upon the mucous membrane of the mouth, fauces, eyelids, prepuce, and female labia, which may be distincly seen two or three days after the first appearance of that upon the skin, in the form of small circular white spots, which, however, contain neither lymph nor pus. Between these the membrane often becomes red and inflamed; and, on the seventh or eighth day of the disease, sore-throat, swelling of the fauces, painful deglutition, and salivation, are apt to come on, which are among the most disagreeable symptoms. The patient is sometimes very much annoyed by the necessity of constantly clearing his throat and mouth from the viscid secretion.

With the progress of the pustules, there is generally more or less swelling of the skin, especially upon the face, where the feeling of burning and tension is often painful. The scalp is also occasionally much swollen. Both the external tumefaction, and soreness of mouth with salivation, increase as the pustules approach maturation, and begin to subside as soon as these have reached their greatest height.

During the period of maturation, the body of the patient exhales a peculiar and disagreeable odour, by which one familiar with the disease can generally recognize it.

About the eighth or ninth day of the disease, a febrile action is again frequently developed, constituting what is properly called the *secondary fever.* Depending exclusively upon the sympathy of the constitution with the local disease, it is most violent, other things being equal, when the eruption is most copious; and, when this is scanty, may be quite wanting. There can be no doubt that a slighter amount of the eruption will excite the fever in some persons than others, owing to their greater predisposition to the disease. Some writers make a difference between this fever and that which prevails in the confluent variety during the period of decline, calling the former the *fever of maturation*, and the latter the *secondary fever.* But there is no good ground for the distinction. In both cases, the fever depends upon the local affection; and that which exists in the decline of the eruption is merely a continuation of that which attends the maturation, except in so far as any intercurrent inflammation may add its influence to that of the pustules. The distinctive character of the secondary fever is, that it is symptomatic, and not, like the primary fever, idiopathic. As it occurs in the distinct variety, it generally declines with the pustules.

The *third or declining* stage is, in this variety, little more than a period of convalescence. About the eleventh or twelfth day, the pustules on the cheeks may be seen to become brown and dryish at top, or some of them break, and the liquid which oozes out concretes into a yellowish brown crust; and from this time the process of *desiccation* goes rapidly on, the swelling of the face subsides, and at last only dry scabs remain, which begin to fall off from the face on the fourteenth or fifteenth day.

But the eruption upon the extremities has scarcely yet arrived at its height, when that upon the face is declining; so that the hands and feet are now considerably swollen; and this is looked upon as a favourable sign, because it indicates a certain vigour in the constitution. It is not till three or four days after the scabs have formed upon the face, that the same process is completed upon the wrists and ankles.

Many of the pustules, instead of forming a regular scab, shrink away in consequence of absorption of their contained fluid, and nothing but a pellicle of cuticle is left, which separates by desquamation. This is especially the case with those upon the arms and legs; and I have repeatedly seen cases, in which there were scarcely any scabs upon the forearms, though they had been full of the eruption. It is generally believed that the pus is absorbed in these cases; but Gregory states that this is not the fact, as no pus exists in these pocks, but only a serous fluid. At all events, the pocks which thus shrink away are often to all appearance fully formed, and differ in nothing to the eye from those upon the face which form scabs.

The eruption upon the mucous membrane is almost always resolved, without the formation of ulcers, or anything that can be considered a scab. It is not the pock upon the conjunctiva or eyelid that produces the ophthalmia from which such serious consequences sometimes follow, in bad cases of smallpox.

The scabs fall off entirely between the fourteenth and twenty-first days. It is a singular fact, mentioned by Rayer and others, that when the skin has been previously inflamed, as in psoriasis, lichen, eczema, &c., the progress of maturation in the pustules is considerably hastened, so that the pocks on the inflamed spot commonly run through all their stages within eight days.

After the falling of the scabs, blotches of a reddish-brown colour are left behind, which sometimes continue for several months before they quite disappear. Some of the pustules, especially those of the face, in consequence of an ulcerative destruction of the true skin, leave scars or pits, which are never effaced. The surfaces from which the scabs have fallen, frequently afterwards undergo a furfuraceous desquamation.

When the scabs begin to form, the fever declines, the tongue cleans, the appetite returns, and, by the time that the skin has been relieved of its burthen, the patient has been fully restored to health. The whole course of the disease occupies from two to three weeks.

2. CONFLUENT SMALLPOX.—This is only a more aggravated form of the same disease, and there is every grade between the extremes of the two varieties. In the more fully confluent forms, the initial fever is more violent, as a general rule, than in the distinct. The pain in the small of the back is more severe; convulsions, delirium, and stupor are more frequent; nausea and vomiting more distressing and obstinate; and the disease more liable to inflammatory or malignant complication. The delirium is occasionally violent and uncontrollable, and, though sometimes associated with signs of inflammatory congestion of the brain, is, in other cases, apparently dependent on excessive nervous irritation alone. Cough, dyspnœa, and pains in the chest are not uncommon, and the epigastrium and other parts of the abdomen are often painful, and extremely tender upon pressure. The eruption appears

somewhat earlier than in the distinct variety, and is not attended with the same complete subsidence of the fever, which, however, almost always in some degree remits.

The eruption is occasionally preceded by a roseolous or erythematous efflorescence upon the face and trunk. The variolous papulæ appear thickly upon the face, in some cases so that scarcely any portion of healthy skin is visible, but more frequently leaving intervals of the surface comparatively unaffected. They are in general more distinct upon the body and limbs; but here also they are frequently more or less confluent; and it sometimes happens that, while distinct upon the face, they are confluent on some other part of the body, as upon the anterior surface of the trunk, or on one of the limbs. In the latter cases, the symptoms are usually less violent.

As the disease advances, the pocks are less regularly developed than in the distinct variety. They do not fill out so amply, nor rise so much above the surface. It often happens that large portions of the face are covered apparently with a nearly uniform layer of pus beneath the epidermis, and sometimes almost the whole face is thus affected. In such instances, the pustules appear to be fused into one mass of suppuration. The inflammation often extends to the subcutaneous cellular tissue, and not only is much of the proper skin destroyed by ulceration, but great havoc is made by the pus burrowing in the parts beneath it.

The eruption in the mouth, fauces, &c., is more copious than in the distinct, the consequent swelling and pain in these parts greater, and the salivation more abundant and distressing. Not unfrequently the eruption and attendant inflammation extend to the larynx and trachea, and to the larger divisions of the bronchia, producing cough, hoarseness, painful attempts at expectoration, and sometimes complete extinction of the voice. This is one of the most dangerous accompaniments of smallpox, causing death by suffocation, in some instances through the closure of the rima glotidis, in others by the clogging of the bronchial tubes with their viscid secretion. Consequent upon this condition in its advanced stages, and arising from a want of arterialization of the blood, are a dark discoloration of the skin, a livid or purplish hue of the eruption, feebleness of the pulse, coolness of the surface, and universal prostration. The deglutition, which is painful from the inflamed state of the fauces, becomes in some of these cases still more difficult, in consequence of the thickening of the epiglottis, and the want of proper adaptation between it and the orifice of the glottis. The nostrils are often stuffed with the tough secretion, or closed by the swelling of the Schneiderian membrane, so as to render breathing through them impossible.

The surface also often swells greatly, especially the face and scalp. Such is the tumefaction that the eyes are frequently closed, almost every feature obliterated, and the whole head enormously enlarged. The patient is occasionally troubled with phymosis or paraphymosis; buboes form in the groin; and parts of the surface where there is little eruption are sometimes affected by an erythematous inflammation.

The eruption usually begins to turn, upon the face, about the tenth day of the disease, and, in place of the broad masses of suppuration, with its cuticular covering, the whole face is often invested with a mask of dark-coloured scabs, beneath which matter still exists, giving a soft mush-like feeling to the parts. Frequently the matter oozes from beneath the scabs; and sometimes when these are torn off or scratched, as they are apt to be in consequence of the insupportable itchiness which attends their formation, a bloody or ichorous discharge from the raw surfaces takes place.

When, along with these phenomena, the intolerable fetor which exhales from the patient is taken into consideration, it may be easily conceived that few objects in nature are more revolting to our senses and sensibilities, than a patient in this stage of a severe attack of confluent smallpox.

The fever, which had remitted upon the occurrence of the eruption, but has never entirely left the patient, increases again on the eighth, ninth, or tenth day; and the new accession is often marked by the occurrence of rigors. This secondary fever may still have more or less of the sthenic character, which in some vigorous constitutions it never loses; but very often it assumes a low form, consequent partly upon the exhausted strength of the patient, and partly also, in all probability, upon the deteriorating effects of the absorbed pus, and putrid secretions, upon the blood. There is now a frequent and feeble pulse, a dark and dry tongue, low delirium, tremors, subsultus tendinum, great muscular weakness, occasionally involuntary evacuations, or perhaps retention of urine; and the patient, if no favourable change takes place, dies either from extreme exhaustion, or the interruption of some one of the vital functions through the severity of local disease.

Should he survive the period of maturation, and pass into that of the decline of the eruption, he has still great dangers to encounter. It is now that disorganizing inflammations are most apt to occur, in various parts of the body. Pseudo-membranous or edematous inflammation of the fauces and larynx, pneumonia, pleurisy, diarrhœa or dysentery, and occasionally inflammation of the brain, complicate the proper variolous symptoms, and often with fatal effect. It is now that those destructive attacks of ophthalmia occur, which are apt to leave behind them the irreparable loss of one or both eyes. Sometimes the cornea sloughs, and the internal parts of the eye project through the opening. Sometimes the whole eye is converted into an abscess. In milder cases, an opacity of the cornea is produced, which either remains permanent, or gradually disappears after several months. Obstinate abscesses of the ear are also occasionally formed. Erysipelas sometimes appears upon the face or elsewhere. In hospitals, this affection is one of the most common attendants on the disease, occurring not only in the period of decline, but also in that of maturation. Troublesome abscesses are not unfrequently developed in the head, neck, and limbs; boils break out over the surface of the body; and various eruptive affections, as the pustules of ecthyma, and the bullæ of rupia, give rise to intractable sores, and greatly add to the distress of the patient. (*Rayer.*) Even when other dangers have been escaped, an extraordinary tendency to suppuration sometimes remains in the cellular tissue, beneath the skin and among the muscles; and I recollect a case of this kind, in which the whole lower limbs appeared almost to dissolve into pus, and the patient sank under enormous abscesses near the end of the third week. Gangrene, also, sometimes attacks the surface, and portions of the skin slough.

Should the disease not prove fatal from some of the above causes, the patient enters at length into a slow convalescence. The scabs fall off, leaving behind them evidences of the ravages of the disease, in numerous pits, and not unfrequently in very unsightly scars and seams upon the face. Occasionally the recovery is attended with the loss of one, and more rarely of both eyes. Any existing tendency to scrofula or phthisis is apt to be developed. Desquamation is seldom completed, and health restored, under three or four weeks; and sometimes entire recovery is still further postponed. There are, however, cases of confluent smallpox which run a more kindly course; and which, after surmounting the dangers of maturation, go on without interruption to a favourable issue. It must be remembered, too, that there are various grades of confluence, some of which are but little more dangerous than the distinct form. Names have been conferred upon certain subordinate varieties, founded upon the amount or arrangement of the eruption; as the *semi-confluent*, when the degree of confluence is moderate, and the *coherent* or *corymbose*, when the pustules appear in clusters, with intervening spaces of sound skin; but such distinctions are of little importance.

There is a condition of the disease, however, which merits a more particular notice. It is that usually designated as *malignant smallpox*, in consequence of its extraordinary virulence. Its peculiarity consists in the association, with the special effects of the variolous poison, of an asthenic state of system, which causes the patient to sink under the disease, at a comparatively early stage, and without the co-operation of these inflammatory complications, which are the ordinary sources of danger at this period. This state of system may be connected with any of the forms of smallpox, the distinct, the confluent, or even the modified form called varioloid. I have known a case of the last mentioned affection fatal in consequence of this associated malignancy. But it is much more frequently observed with the confluent than the other forms. It is evinced either, *first*, by an utter prostration of the nervous power, inducing inefficient reaction, with coma, delirium, or excessive restlessness and anxiety, and sometimes an imperfect developement of the eruption, or a sudden retrocession of it when formed, or, *secondly*, by those symptoms which characterize a depraved condition of the blood, such as petechiæ or vibices, oozing of dark blood from the mucous membranes or abraded surfaces, a purplish or bloody and badly developed eruption, which fills partially, and rises but little above the surface, paleness or lividity of the intervening skin, a disposition to gangrene, oppressed breathing, an anxious countenance, and great feebleness of the circulation. Sometimes the signs of malignancy do not exhibit themselves in the primitive fever, unless perhaps by unusual severity of the lumbar pains; but in other instances they are striking almost from the beginning, and there is reason to believe that patients have sunk under them before the period of eruption. Death, however, generally takes place from the seventh to the ninth day of the disease. It is this form of the complaint to which the name of *black smallpox* (*variolæ nigræ*) has been sometimes applied.

3. VARIOLOID, or MODIFIED SMALLPOX.—Different writers on smallpox had recognized various modifications of the disease, occurring especially during its epidemic prevalence, long before vaccination was known. Such were the variolous fever without eruption (*variolæ sine variolis*); the *crystalline pock*, in which the eruption continued vesicular; the *stone-pock*, *horn-pock*, and *wart-pock* (*variola verrucosa*, or *v. cornea*), in which the vesicles dried up into small tubercules, instead of proceeding onward to maturation; and several others which it would be profitless to enumerate. Most of these are now perfectly familiar to us as the result of the modifying influence of vaccination, or previous smallpox, and are confounded under the general name of varioloid, which has, with great propriety, been given to the diversified forms of the disease originating in the cause alluded to.

Some have considered the disease which occurs in individuals partially protected, to be a distinct affection, having a peculiar contagion of its own, and bearing to smallpox the same relation as varicella or chickenpox. But that it is nothing more than a modified variola is proved by the facts, that it is produced by exposure to the contagion of smallpox, and is itself capable of producing smallpox in the unprotected. The great diversity, moreover, of its forms, taken in connexion with its identity of origin, would appear to show that it could not be a peculiar disease resulting from the unmodified influence of a distinct cause, but must owe its diversity to the unequal degree of some protecting influence in the individuals attacked by it. This diversity is so great that it would be utterly impossible, within any moderate limits, to describe minutely all the shapes which it assumes. There is, in fact, every shade between the slightest symptoms, scarcely recognizable as having affinity with smallpox, and the nearest possible approach to the regular disease. It will be sufficient to notice some of the more prominent of these varieties.

I have not the least doubt that the variolous fever occurs in some individuals who want but little of being perfectly protected, without any eruption whatever. Such a fever, of about three days' duration, has frequently come under my notice during variolous epidemics, and could be explained in no other way than by reference to the prevalent influence. I have always observed it in persons who had been previously vaccinated or affected with smallpox.

In cases attended with eruption, which are vastly more frequent than those just mentioned, the fever is of various grades of violence and duration, sometimes commencing with rigors, exhibiting the characteristic symptoms of severe lumbar pains, headache, and obstinate vomiting, and terminating upon the third or fourth day, but in other instances slighter, shorter, and occasionally scarcely sufficient to attract notice. Judging from my own observation, I should say that, in the greater proportion of cases, it is very regular, bearing a much nearer resemblance to the fever of unmodified smallpox, than the subsequent eruption does to the eruption of the genuine disease. Indeed, one of the most striking circumstances, in connexion with varioloid, is the frequently slight proportion which the amount of eruption bears to the severity of the preceding fever. I have known a high fever lasting three days, to be followed by a single pock upon the breast.

Another circumstance in the eruption, worthy of notice, is that occasionally the appearance of the proper papulæ, as in the confluent smallpox, is preceded by a scarlet efflorescence like that of scarlatina or roseola, which might be alarming were there not evidence of previous vaccination or inoculation, but, under these circumstances, is quite insignificant. It is often followed by a very small crop of the true varioloid eruption.

Not unfrequently the eruption is copious, and, in some rare instances, it is even confluent. It much more frequently occurs first on the body, than is the case in the genuine disease. The character of the eruption, and its progress, are not less diversified than its amount. Sometimes it never advances beyond the state of mere papula or pimple; though this is comparatively rare. In much the greater number of instances, it stops short in the vesicular stage, or undergoes but a partial and imperfect suppuration, and begins to dry on the fourth or fifth day of the eruption, forming a small hard tubercule, which soon disappears. Sometimes the vesicles are scarcely umbilicated; or at least a much larger proportion of them are not umbilicated than in regular smallpox. On this account, it is occasionally difficult to distinguish the disease from varicella. In other instances, again, the pock becomes clearly pustular; and it is not uncommon to see the three forms of pimple, vesicle, and pustule in the same case, and at the same time.

In many instances, the eruption runs its regular course, in all respects like that of genuine smallpox, becoming pustular, and even convex at top, but stopping one or two days sooner, on the sixth or seventh day of the eruption, for example, instead of the eighth or ninth. I have thought that this difference has sometimes been the cause of safety to the patient; and I have looked with great anxiety for the signs of a commencing change upon the sixth day.

Another striking difference between the severest forms of varioloid and genuine variola is the absence of odour in the former. This is generally quite wanting, and always, so far as I have observed, very slight compared with that which is exhaled at the same stage, and with an equal amount of eruption, in the unmodified disease.

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Cause.

The cause of smallpox is universally admitted to be a specific contagion. This is indeed one of the most contagious of diseases. There are very few not protected by vaccination, or a previous attack of the disease, who are not liable to be affected by it on exposure. Occasionally an individual is met with who has resisted the effects of the contagion to old age; but even such persons are not secure; for instances are on record in which, after frequent exposure to the cause of the disease without effect, a fatal attack has at length occurred, perhaps in advanced life; and, in persons who have escaped the disease in the natural way, it has been produced by inoculation. Even the fœtus in the womb is liable to be affected along with the mother; and it has been asserted that the effect has taken place when the mother herself was either partially or wholly protected.* The idea has been advanced, that some of those persons who seem exempt from the disease, may owe their want of susceptibility to a previous attack of it in the fœtal state. The contagion acts either through the air, or by contact in the liquid or solid form with the sound skin or the mucous membranes, or by insertion beneath the cuticle. What products of the diseased body are contagious is not exactly known; but the purulent contents of the pustules, and their dried scabs certainly are so; and it is asserted that the disease has resulted from bleeding with a lancet which has been used in a previous case, and not properly cleansed.

Opinion is not settled as to the period of the disease at which it is contagious; some believing it to be so only after the commencement of suppura-

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* See the report of a case by Dr. Wm. T. Taylor, illustrative of the fact that the fœtus may be attacked with genuine smallpox through the mother when partially protected. (*Am. Journ. of Med. Sci.*, N. S., xxvi. 127.) Dr. Mead relates a case in which a pregnant woman, wholly protected by a previous attack of smallpox, attended upon a case of the disease, and soon afterwards was delivered of a dead child covered over with pustules; the mother escaping.

These two signs, the shorter duration of the eruption, and the comparative absence of odour, may be considered as diagnostic signs of varioloid. Any case without them must be looked upon as true smallpox.

Secondary fever is very rare in varioloid; though it does occasionally take place in the severer cases.

Varioloid is very seldom dangerous, and is much less apt than smallpox, with an equal amount of eruption, to leave pits behind. Nevertheless, these do occasionally take place. The disease may also prove fatal. But when it does so, it is generally in consequence of some accidental complication. The only two instances of death from varioloid which I ever witnessed, arose, the one from a malignancy of system which caused a fatal termination before the complete maturation of the pustules, the other from the occurrence of inflammation of the brain, which, from the state of the patient's constitution at the time, would very probably have occurred in any other febrile disease.

Notwithstanding the generally protective or modifying influence of previous vaccination or variola, it must be confessed that genuine smallpox, perfect in all its stages, has sometimes followed these diseases; while, on the other hand, modified forms of the complaint have been noticed in persons who had never been affected with either of them.

Before closing the symptomatology of smallpox, it will be proper to notice the fact, that it is sometimes materially modified by other eruptive affections, especially measles, scarlatina, and purpura, the simultaneous occurrence of which sometimes serves considerably to embarrass the diagnosis. In relation to measles, it has been observed that they will sometimes supersede a commencing variola, which will return and finish its course, after the intercurrent disease has subsided. It has been already stated that smallpox favours the developement of scrofula and phthisis. It is said sometimes to have cured intermittent fever, and to have superseded some of the neuroses, as epilepsy, for example, at least for a time.

Anatomical Characters.

The only characteristic alterations are those upon the skin and mucous surfaces. It is true that signs of inflammation are often found in the lungs, pleura, membranes of the brain, &c.; but these lesions are neither constant nor essential, and offer nothing in smallpox to distinguish them from analogous changes in other diseases. Some importance has been attached to the redness sometimes observed upon the internal surface of the arteries; but this appears to be generally owing to mere imbibition of blood. In malignant cases, the blood is found to have undergone the same changes that have been noticed in other malignant diseases. When taken from the arm during life, it sometimes contains a small excess of fibrin, and, upon coagulation, exhibits the inflammatory crust, which, however, is usually soft and gelatinous. In typhoid cases, the proportion of fibrin is diminished.

The structure of the pustule is peculiar. A portion of the true skin at its basis is reddened, and sometimes ulcerated. Upon the surface of this, and beneath the cuticle, is a disk of pseudo-membranous matter, which, in the earlier stages of the eruption, adheres to the inner surface of the cuticle, and less firmly to the chorion beneath it. The colour of this disk is dull-white, and its consistence rather friable. At a more advanced stage, a serous or purulent fluid is observed in small vacuities, or a winding cavity, between this adventitious product and the surface of the true skin; and, when the pustule is mature, a layer of pus separates it also from the cuticle. According to Rayer, "the size, colour, and umbilicated depression of the pustules depend on the pseudo-membranous disk, secreted by the papillary body, in-ordinary tendency to certain other cutaneous diseases, or to eruptive affections in general. Dr. Gregory states that smallpox has never yet been seen in Australia and Van Dieman's Land. (*Lecture on the Eruptive Fevers*, Am. ed., p. 79.) This has been advanced as a strong fact against the spontaneous origin of the disease; yet no one supposes that yellow fever does not occur spontaneously in America, because it is unknown in Asia. Variolous epidemics observe no regular rule of recurrence. They may approach at one season as well as at another. Sydenham, however, observed that, when they commence in the middle of winter, as in the month of January, they are apt to be more violent than when they make their approach in spring, about the vernal equinox.

In relation to the effect of the contagion, it does not appear that the peculiar character of the communicating case has any influence upon the form or grade of the one produced. Thus, the severest confluent case may produce the mildest form of the distinct variety, and *vice versâ*.

The time which intervenes between the reception of the poison, and the beginning of the primary fever, is generally from nine to twelve days; but the attack is asserted to occur sometimes so early as the fifth day, and in other instances to be postponed to the end of the second or third week.

Diagnosis.

When regular smallpox has run through its whole course, or has reached an advanced stage, there can be no difficulty whatever in distinguishing it from all other diseases. Its symptoms are quite characteristic. But the same cannot be said of all its stages, nor of all its modifications. The initial fever offers no symptom by which it can be distinguished, with certainty, from other fevers. The most experienced physicians are sometimes deceived. Yet there is, in some cases, a certain aspect which may well induce suspicion. Severe pain in the lumbar region, for example, and excessive irritability of stomach, ascribable to no obvious cause, would be apt to direct the attention to smallpox; and, if the disease were prevalent at the time, would afford highly probable evidence of its variolous nature. Should a papular eruption now occur upon the third or fourth day, with a subsidence of the fever, the proof would be almost conclusive; and should the eruption shortly become vesicular, with an umbilicated summit, it would be quite so.

There may be some difficulty, for a moment, in distinguishing the variolous eruption, at its first appearance, in a confluent case, from that of measles or febrile lichen; but, in the former of these complaints, the eruption is less prominent and distinct to the touch, in the latter, the preceding fever is of much shorter duration. A day or two, however, must remove all difficulty by the further developement of the eruption.

Varioloid, or modified smallpox, sometimes offers considerable difficulty in the diagnosis. In relation to those cases in which there is no eruption, there must always be some doubt. So also, perhaps, in those in which the eruption does not advance beyond the papular state; though the duration of the fever, and its complete subsidence at the appearance of the eruption, in connexion with a known exposure to variolous contagion, might be considered as almost decisive. Between certain cases of varioloid and varicella, or chickenpox, there is absolutely no observable difference; but, in general, the two complaints may be readily distinguished by the much shorter duration of the eruptive fever in the latter, and by the absence of umbilicated vesicles or pustules.

Prognosis.

Unmodified smallpox is a very fatal, and was formerly an exceedingly destructive disease. The general average of deaths is stated at one in four. Under favourable circumstances of living and treatment, it would undoubtedly be much less. The varieties differ greatly in the degree of their danger. The distinct, when uncomplicated, is seldom fatal; the fully-formed confluent disease is always very dangerous; the malignant almost always ends in death. The fatal cases of varioloid are comparatively very few; and, in the vast majority of instances, the affection is quite trifling, except from the consideration that it may be the source of danger to the unprotected.

It may be considered a favourable sign when the disease pursues its regular course towards desquamation, without any serious inflammatory complication, and without malignancy; but cases sometimes occur, in which, without obvious cause, the vesicles or pustules suddenly shrink, and the patient sinks; and, until convalescence is completely established, there is never any positive security, in the confluent variety, against dangerous or fatal intercurrent disease.

The signs which may be looked upon as especially unfavourable, though by no means all of them necessarily fatal, are excessive lumbar pains; the continuance of vomiting after the appearance of the eruption; violent delirium, coma, or convulsions in the first stage, except in children; great abundance and confluence of the eruption; the simultaneous appearance of the eruption over the whole body; a want of redness about the pock; a livid or purplish colour of the pustule; petechiæ and vibices, with passive hemorrhage; imperfect developement of the pustules, or their sudden subsidence, without diminution of the other symptoms; appearance of the bullæ of rupia among the pustules; sudden disappearance of swelling of the face and salivation, and the want of swelling in the hands and feet when the eruption is copious; great hoarseness or complete extinction of voice, with difficulty of respiration; the occurrence of pneumonia or pleurisy; convulsions or coma in the advanced stages; the suppression of urine, or involuntary discharges whether of urine or feces; and, finally, a disposition to the formation of large abscesses after the commencement of desquamation.

The disease is more fatal at the two extremes of life than in its intermediate stages. Plethora and debility are both unfavourable. The intemperate are very apt to die. The disease is often fatal, and always dangerous in pregnancy; and abortion not unfrequently ensues.

Death may take place at any period of the disease, from the time of attack to the end of the fifth or sixth week. From a table of Dr. Gregory, it would appear that the greatest number die on the eighth day. Out of 168 fatal cases, 27 died on the eighth day, and 16, which was the next highest number, on the eleventh. Comparing the different weeks, the mortality was much the greatest in the second, being 99; while in the first week it was 32, in the third 21, and in the fourth or later 16. (*Tweedie's Syst. of Pract. Med.*) But it should be observed that these were cases in a London hospital, in which there was no doubt a much greater malignancy, and consequently a tendency to earlier termination than in private practice. Judging from my own observation, I should suppose that the greatest number of deaths, under the latter circumstances, occur between the twelfth and eighteenth days.

Treatment.

In few diseases has medical opinion undergone a more beneficial change than in this. Under the impression that the eruption was an effort of nature to rid the system of noxious matter, which if retained must prove fatal, it was formerly deemed important to favour instead of repressing the process. It was known that heating and stimulating measures promoted the eruption. Hence arose the practice of sedulously excluding fresh air from the sick room, heaping up bedclothes upon the patient, giving him hot drinks, and not unfrequently administering stimulants. Now that the greatest danger in smallpox is known to arise from the copiousness of the eruption, it will be readily understood, how fatal must have been the disease under the old system of practice. To Sydenham belongs the credit of changing the current of medical sentiment in this respect. Having practically ascertained the favourable effects of an opposite plan of treatment, he recommended it in his works; and refrigerant measures are now universally admitted to be the most efficient in the cure of the disease, as they certainly are the most agreeable to the patient.

As the course of smallpox cannot be abruptly shortened, and as the danger arises partly from the reaction of the copious eruption upon the system, partly from intercurrent inflammation of the lungs, larynx, &c., and partly from the exhaustion consequent upon the long-continued irritation and discharge, it is clear that the important indications of treatment are, not to attempt by violent means to break up the complaint; but 1. to moderate the amount of pustulation without impairing the strength; 2. to obviate in all stages the effects of inflammation; and 3. to support the system when requisite in the advanced stages. The comfort of the patient also should be studied, and means employed to relieve those painful annoyances, and allay those nervous disturbances, which are so incident to this complaint. The treatment is to be conducted upon general principles. There is no specific remedy in smallpox.

In mild cases, which, if not disturbed, will of themselves run a favourable course, the physician should be contented with guarding the patient against injurious influences, such as heating drinks, stimulating food, confined air, and unnecessary exposure to cold; limiting himself, in regard to medicines, to refrigerant diaphoretics and cooling drinks during the fever, and to an occasional laxative if the bowels should be confined.

In severer cases, it becomes necessary to interfere more efficiently. At the commencement of the primary fever, a full dose of some efficient cathartic should be given, as the compound cathartic pill of the U. S. Pharmacopœia, calomel and rhubarb, calomel and compound extract of colocynth, or senna and salts; and afterwards the bowels should be kept open by saline cathartics, magnesia, castor oil, or rhubarb, as circumstances may seem to require. The Seidlitz powder will be found useful in some cases with irritable stomach. After the bowels have been well evacuated, saline diaphoretics should be given, especially citrate of potassa, in the form of neutral mixture or effervescing draught; the latter being especially applicable, when there is a tendency to nausea and vomiting. The antimonials in small doses may be added, when the stomach is in no degree irritable. Nitrate of potassa, solution of acetate of ammonia, and spirit of nitric ether, may also be employed if deemed advisable. The skin, if very hot and dry, may be sponged with cool water; but care must be taken not to apply this too extensively; and, as a general rule, it may be safest to confine it to the arms and face. The necessity for caution in this respect arises from the proneness to internal inflammations. Sponging with warm water may be more freely employed, and often affords relief.

Should the pulse be full and strong, and evidences of inflammatory congestion be presented by any important organ, as the lungs, head, or stomach, blood may be taken moderately from the arm, and cups or leeches applied freely in the vicinity of the organ affected. In doubtful cases, the abstraction of blood should be exclusively local. Bleeding should never be used in the hope of eradicating the fever, or diminishing the amount of the eruption. It has been well ascertained to have neither of these effects, at least with the slightest approach to certainty. After the most copious loss of blood, the eruption is often quite as abundant as when the disease is left to nature. It may possibly, indeed, sometimes keep back the eruption by exhausting the system; but the loss is here much greater than the gain. Sometimes, when the eruption seems to be kept back by powerful internal irritation, bleeding has the effect of hastening it. The practitioner should always bear in mind the long subsequent struggle, and how necessary it is to husband the strength against the last failing period. I repeat, the bleeding should be employed only to avert threatened danger from some important organ. It is necessary not to be misguided by the pains which so commonly attend severe smallpox in this stage. They are often purely nervous, especially those in the back, and so far from indicating depletion, are probably severest in the most asthenic state of the system. Even the pains in the head are also frequently nervous. The strength and fulness of pulse are a surer guide; and, in reference to the organs, bright redness and flushing of the face, great epigastric tenderness upon pressure, and the physical signs afforded by auscultation and percussion, taken in connexion with the pains, are more to be depended on than the pains themselves in the head, stomach, or chest.

When there is much restlessness or wakefulness, severe neuralgic pains, with a frequent pulse, and no evident signs of cerebral congestion, much relief may often be obtained from opiates, especially in the form of Dover's powder, or of opium with ipecacuanha and calomel at bedtime. The warm bath also will often be useful, under such circumstances. For the vomiting, which is so troublesome a feature of the complaint, the effervescing draught, with a little morphia, black drop, or laudanum; small draughts of iced carbonic acid water; a sinapism to the epigastrium; and, these failing, an anodyne enema, are the most efficacious remedies. Should the epigastrium be very tender, leeches and subsequent emollient cataplasms are indicated. For cerebral congestion, the hair should be thinned or removed, cold water or ice applied freely to the forehead and scalp, and cups or leeches to the temples or back of the neck; while excitement is invited towards the extremities by hot or stimulating pediluvia, mustard to the legs, &c. Should symptoms of laryngeal or pectoral inflammation appear, local depletion and emollient cataplasms are indicated. The drinks should be such as have been recommended in other fevers, and should always be given cool. Cold water or lemonade is, perhaps, on the whole, the most acceptable to the patient. The diet should consist exclusively of mucilaginous, saccharine, or amylaceous liquids.

In order to invite the eruption towards the lower extremities, and away from the face, some practitioners recommend warm pediluvia, and warm emollient cataplasms, or blisters to the legs. It is also advised, in cases of tardy eruption with threatening constitutional symptoms, to have recourse to an emetic, the warm or vapour bath, diaphoretics, such as acetate of ammonia and Dover's powder, and, if necessary, to moderate stimulation. I can say nothing of these remedies, under the circumstances alluded to, from my own experience.

After the appearance of the eruption, little treatment is required for some time. Should the fever continue, the refrigerant diaphoretics before mentioned may also be continued, in diminished doses, and at longer intervals. Gentle laxatives are sometimes required to keep the bowels open. Nervous symptoms may often be quieted by spirit of nitric ether, Hoffmann's anodyne, or camphor water; and an opiate should be given at night, if necessary to procure sleep. The regimen should still be cooling; though food somewhat more nutritious may be allowed, such as gruels, panadas, toasted bread and tea, water crackers, roasted apples, oranges or grapes, milk and water, rennet whey, vegetable broth, &c.; reference, of course, being always had to the degree of excitement. The diet, however, should be strictly antiphlogistic.

Upon the occurrence of secondary fever, the original diaphoretic and refrigerant plan should be resumed, in a degree corresponding to the excitement, and the apparent strength of the patient; and a still more guarded attention is necessary to the supervention of inflammations. For the relief of these, however, at this stage, more must be expected from local measures than general bleeding, which requires to be employed with great caution. Opiates may almost always be advantageously used at this period, and throughout the remainder of the disease, unless contraindicated by decided symptoms of cerebral inflammation. They calm the nervous disturbance, and render the system much less susceptible to the excessive annoyance of the local affection. Combined with calomel and ipecacuanha, opium is also an excellent remedy in the inflammations of this stage. Should they be severe enough to threaten life, the calomel may be very properly pushed to a moderate salivation, or till the gums are slightly touched.

But there is another great danger to be guarded against in the advanced stages. It is often necessary to support the system under the prostrating effects of the abundant suppuration, and vast irritation of the pustules. When, therefore, any appearance of flagging is presented; when the pulse begins to weaken, the tongue to become dry and dark, and the extremities to show a want of due action, recourse should be had to tonics and stimulants, and to a nutritious diet, proportionate to the apparent wants of the system. The particular remedies to be employed are sulphate of quinia or compound infusion of Peruvian bark, the mineral acids, the malt liquors, and wine either pure or in the shape of wine-whey. When the prostration is great, carbonate of ammonia, ether, and brandy may be added to the list. Camphor is an excellent addition to the other remedies in cases attended with nervous disturbance. When the surface is cold, external heat must be applied. The diet in these cases should be nutritious, and sometimes stimulating. Milk, animal broths, jellies or essences, and eggs, raw or soft boiled, may be used in addition to the substances before employed.

In the malignant cases, it is necessary to have recourse to this supporting plan of treatment early in the disease, or at any period when the symptoms of malignancy may show themselves; though it must be acknowledged that little good is to be expected from these or any other measures.

It is necessary, throughout the complaint, to attend to the various inflammatory complications. The method of treating these has already been pointed out. The only additional observation which seems to be required in this place is, that, when they occur in the advanced stages, they cannot be treated by depletion so freely as at the beginning; and that reliance must now be placed chiefly upon leeching, emollient applications, and blisters externally, and the careful use of mercury with opiates internally. The diarrhœa which occasionally attends the complaint must be treated on general principles. (See *Diarrhœa.*) Convulsions, when they occur in the early stage, and are attended with an active pulse, require the treatment appropriate to active cerebral congestion. At a more advanced period, and when dependent on mere nervous irritation, they may sometimes be advantageously treated with opiates, the nervous stimulants or antispasmodics, and the warm bath.

Attention, throughout the case, should be paid to the diseased surfaces. Lotions of cool water, demulcent liquids, milk and water, or weak lead-water, may be applied to the face when much inflamed; purulent matters should be removed from the eyes by frequent washing; children should be prevented from scratching the pustules, which sometimes itch intolerably; moisture exuding from the pustules, or excoriated surfaces, should be absorbed by sprinkling them with rye meal, powdered starch, calamine, or tutty; or, if the parts are inflamed, they should be anointed with cold cream (unguentum aquæ rosæ, U. S. Ph.), or Goulard's cerate diluted with lard. The nostrils should be cleaned out in infants; and cooling or slightly astringent washes or gargles should be employed for the mouth and fauces. Should a pseudo-membranous exudation be observed in the fauces, it should be treated with a strong solution of nitrate of silver, or with that caustic in substance.

In consequence of the repulsive deformity of face which frequently follows smallpox, it has always been an object of interest to find some method of checking the progress of the eruption, and causing it to abort, so as to prevent pits and scars. The Arabian physicians were in the habit of opening the pustules after suppuration had commenced, of pressing out their liquid contents, and of then washing the surface with warm milk and water, decoction of poppy-heads, &c.; and Rayer speaks favourably of the practice. But a more effectual method is that of cauterizing the pustules with nitrate of silver, as recommended by Bretonneau and Serres. The former cauterized each pustule separately, the latter made the application to masses of the eruption. The best plan is probably to open each pock upon the face, as soon as it has become vesicular, either by a pointed probe or lancet, and then to apply a stick of nitrate of silver brought to a fine point, or a very strong solution by means of a probe. The progress of the eruption is thus frequently completely arrested; and, at the end of a week, the scales fall of without leaving pits. To succeed, however, the operation must be performed as early as the second, or at furthest the third day. When the solution has been applied uniformly over large surfaces, it has been found that the work of suppuration and ulceration still goes on beneath the blackened cuticle.

Still another method of causing the pustules to abort is the use of the mercurial plaster, as recommended by M. Briquet, who deserves the credit of bringing the method into general notice, though known and practised by others before him. If applied at the very commencement of the eruption, it is asserted to have the effect of producing a resolution of the papulæ; if during the vesicular stage, of causing them to dry up into tubercules, or at least preventing suppuration, and ultimate pits or scars. No injury results to the constitution from this abortion of the pustules, but, as is asserted, rather benefit from the diminished amount of irritation. The effect is ascribed to the specific action of the mercury; as other methods of excluding the air were not found so effectual. The *emplastrum de Vigo* of the French Codex (see *U. S. Dispensatory*, article *Emplastrum Hydrargyri*) is asserted to be more effectual than the mercurial ointment. I have employed the latter, however, with decided benefit. The application is usually confined to the face. The whole face should be covered by the plaster as by a mask, openings being left for the eyes, nostrils, and mouth. The plaster may be removed after four or five days. If longer continued, it is apt to produce unpleasant irritation. The only hazard from this remedy is a mercurial salivation, which, however, does not usually occur, and should it do so, would perhaps be rather useful than injurious.*

It is said that sulphur ointment, applied several times a day to the face, in the earliest stage of the eruption, has had the same effect; and a similar influence is claimed by Professor Bennet, of Edinburgh, for calamine mixed with olive oil, which forms a coherent crust, and thus excludes the air. (*Ed. Month. Journ. of Med. Sci.*, April, 1854, p. 301.) Dr. Samuel Jackson, of Philadelphia, formerly of Northumberland, employed the tincture of iodine for the same purpose with apparent advantage. He applied the tincture freely and continuously over the affected surface by means of a camel's hair pencil. Drs. F. Sargent and Goddard, of the same city, afterwards made the application in numerous cases; the former, with a decided effect in diminishing the inflammation and swelling, but with no appreciable influence on the pitting; the latter, with a complete prevention of pitting, even in confluent cases. (*Med. Examiner*, N. S., ii. 465.) It appears, however, from a communication in the *British American Medical Journal*, for Nov. 1846, that the credit of having first employed tincture of iodine for this purpose belongs to Dr. Crawford, of Montreal, who applied it in a case so early as the year 1844. (*Ranking's Abstract*, No. 5, p. 66.)

The idea has been advanced, that the influence of the atmospheric air is essential to the developement of the pustules, and consequently that they may be rendered abortive by anything which will exclude this influence. M. Serres has found that their progress is arrested by covering them with little cups of darkened glass, or involving them in honey or fatty matter (*Am. Journ. of Med. Sci.*, N. S. xvii. 183, from *L'Union Méd.*, Oct. 1848). Collodion has been employed for the same purpose, with asserted success, by several practitioners; but Dr. Christen, who tried its effects in the Prague Hospital, found it ineffective to the end proposed, and otherwise injurious. (*Ibid.* xxv. 487.) Dr. Graves, of Dublin, recommends a saturated solution of gutta percha in chloroform, but states that it should not be applied until after the pustules have fully maturated, or even begun to decline, as before this period it is mischievous. (*Dublin Quart. Journ. of Med. Sci.* xiv. 7 and 224.)

During the period of desquamation, advantage will sometimes accrue from the occasional use of the warm bath; and the patient should always resort to this measure before again mixing with the world.

Throughout the treatment, the greatest care should be taken to keep the apartment well ventilated, to change the clothing of the patient and his bedclothes frequently, and to remove everything offensive from the chamber.

Prevention.

Perhaps the greatest triumph of modern medicine is the discovery of a sure preventive of smallpox. There are two modes of protecting the individual, inoculation and vaccination, the latter of which has the great advantage, that, so far as it goes, it protects the community also. The subject of inoculation I shall treat of in this place; that of vaccination is sufficiently important to entitle it to separate consideration under a distinct head.

By *inoculation* is technically meant the imparting of smallpox by the insertion of the virus into the skin. The disease thus produced, while infinitely milder and safer than when taken in the natural way, is scarcely less effectual in protecting against a second attack. It was, therefore, a happy discovery, and was employed with vast individual benefit before vaccination became known. It is said to have been practised from the earliest times in India, and was certainly familiar to the people of Turkey long before it became known in western Europe. It was introduced into England chiefly through the agency of the celebrated Lady Montagu, who became acquainted with it while residing in Turkey, as the wife of the British ambassador. Though much opposed at first, it gradually made its way into almost universal adoption.

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* A preparation employed in the Children's Hospital in Paris, and which succeeds "marvellously well," is made by incorporating together 25 parts of mercurial ointment, 10 parts of yellow wax, and 6 parts of black pitch. It is said to be completely efficacious. (*Journ. de Pharm.* 3e sér., viii. 282.) M. Briquet recommends mercurial ointment simply thickened with powdered starch. (*Am. Journ. of Med. Sci.*, N. S., xiii. 438.) As the ointment sometimes salivates, it should be diluted with an equal proportion of lard, and then stiffened with the starch.

Different modes of introducing the virus were employed, some of which were awkward, and unnecessarily painful. The most convenient, and one as effectual as any other, is, by means of a puncture in the arm, to insert a small portion of pus from a variolous pock, exactly as is done in the operation for vaccination. Much was said about the requisite preliminary preparation of the system, in order to secure a mild affection. But, according to the best testimony, the most favourable condition is that of perfect health; either plethora or debility being unfavourable. Hence, it was thought advisable that, for some time before the operation, the patient should confine himself to a mild and moderate diet, and avoid stimulants of all kinds, as well as fatiguing exercise, and every kind of excess.

The following is the course of the disease thus artificially produced. On the third or fourth day after the operation, a slight pricking pain is experienced in the part, a hard elevation may be felt by the finger, and a minute vesicle upon an inflamed base may be seen upon close examination. On the fifth day, the vesicle is well formed, and has an umbilicated appearance. This goes on increasing, and forms at length a small tumour like a phlegmon. At the end of the seventh day, rigors are felt, followed by fever; and, on the eighth or ninth, a variolous eruption makes it sappearance in different parts of the body. This is almost always distinct, and generally moderate. One hundred pocks are a pretty full crop. A rose-coloured efflorescence often precedes the eruption on the eighth or ninth day. The pocks generally pass through the several stages, as in the distinct variety; though in some few instances they are said to be abortive. In the mean time, the original pustule has been advancing, and, on the tenth or eleventh day, is surrounded by an irregular areola of inflammation, while the arm is often much swollen, and pus escapes from the tumour. No secondary fever occurs, and the pocks scab and desquamate kindly, seldom leaving any unpleasant effects behind.

Occasionally inoculated smallpox proved fatal; but, where proper care was taken that the state of the system should be suitable before the operation, and that the patient should be preserved from injurious influences afterwards, the proportion of deaths was very small, not exceeding, according to Gregory, one in five hundred. Small, however, as the danger is, it forms one objection to the operation; but another and much more serious one is, that, though it protects the individual inoculated, it makes him the centre of a contagious influence, and thus tends almost inevitably to keep up the disease in the community. Hence, society has deemed it necessary, in some places, to protect itself against mischief by forbidding the practice of inoculation under a heavy penalty.

Article VIII.

VACCINE DISEASE.

Syn.—Cowpox.—Kinepock.—Vaccina.—Vaccinia.

This is a disease characterized by the existence upon the skin of one or more umbilicated vesicles; by being communicable by means of inoculation, though not through the medium of the air; and by the property of rendering the system, in a greater or less degree, insusceptible to the contagion of smallpox. The different names by which it is known all have reference to its origin from the cow. The term vaccination is used to signify the act of imparting the disease by the insertion of its peculiar virus into the skin.

The fact that a disease occasionally appeared in the cow, capable of being imparted to man, and of securing him against smallpox, seems to have been long since known, and to a limited extent acted upon in different parts of the world, as in India, Persia, and South America (*Dict. de Méd.*, xxx. 393); and it was by the existence of a popular belief of this kind in his neighbourhood, that Dr. Jenner was led to those investigations and experiments which have had such important results. Though not, therefore, the first to conceive or to practice the artificial communication of the vaccine disease, that celebrated and most fortunate physician merits the exclusive credit of having brought the art into general and profitable use; and the idea of propagating the disease from individual to individual, after it was received from the cow, appears to have been quite original with him. Nor was the discovery a mere happy thought, which required only to be suggested in order to be established. On the contrary, it was only after a painful course of observation and trial, and amidst discouragements which would have extinguished a less ardent enthusiasm, that he succeeded at length in placing it upon a firm basis, and in gaining for it that universal acceptance which he lived to witness. To him, therefore, the world has almost unanimously ascribed the honour of the discovery; and the gift of 30,000 pounds sterling, by the British Parliament, was but a small acknowledgment of the unspeakable benefit which he had conferred upon mankind.

It was in the county of Gloucester, in England, that the first observations were made by Dr. Jenner. Being largely engaged in the practice of inoculation in that neighbourhood, he found certain individuals who obstinately resisted the infection, and ascertained, in relation to these persons, that they had been affected with the complaint derived from cows, which was supposed to be a preservative against smallpox. The idea occurred to him, that this might be artificially communicated with the same effect; and it was verified by experiment. The next step was the conception, before alluded to, of conveying the disease from one person to another, which was equally verified. Having collected a sufficient amount of proofs, Dr. Jenner, in June, 1798, published his essay, entitled "Inquiry into the causes and effects of the Variolæ Vaccinæ," in which he set these proofs forth with such effect as to excite immediate attention, and to enlist the enthusiastic co-operation of numerous individuals. New evidence was rapidly accumulated; and the practice of vaccination spread with great rapidity. In 1799, it reached the United States; in the following year it was admitted into France and other parts of continental Europe, and was even conveyed to India; and very soon there was scarcely any portion of the world which had not been made acquainted with it.

Disease in the Cow.—The animal seems to suffer at first under what may be considered as the eruptive fever. Upon the third or fourth day, several small pocks appear upon the teats, and sometimes on the eyelids and nostrils, which gradually enlarge, assume the silvery appearance and umbilicated form characteristic of the vaccine vesicle, and, arriving at their height, begin to dry on the eleventh or twelfth day of the eruption. These pocks, broken in the act of milking, impart their contents to the hands of the operators, which become sore if accidentally abraded. The disease is not common in the cow, prevailing only in certain districts, and not always in these. Dr. Jenner supposed that it was conveyed to that animal from a complaint in the foot of the horse, denominated *grease*, the matter of which might attach itself to the hands of the ostlers, and, as men are in Gloucestershire employed in milking, might by them be imparted to the teats of the cow. But this supposition has not been confirmed by subsequent experiment. The idea has been advanced, and is not without plausibility, that the complaint in the cow is the effect of the contagion of smallpox received from man, and modified in the system of the inferior animal. Dr. Jenner believed that smallpox and cowpox were merely different forms of the same disease. Mr. Ceeley, of England, inoculated the cow with variolous matter, and, having introduced into the human subject some of the virus from the resulting pock, succeeded in producing a complaint, which was afterwards transmitted from individual to individual, with all the phenomena and effects of cowpox. This experiment was repeated with the same results by Dr. John C. Martin, of Attleborough, Massachusetts, in 1835 (*Med. Exam.*, iv. 782, from *Bost. Med. and Surg. Journ.*), and by Dr. Basile Theile, of Kassan, in Russia, in 1836 and 1838 (see *Am. J. of Med. Sci.*, N. S., ii. 467); and there would seem to be little doubt remaining upon the subject, if confidence can be placed in medical testimony. But it does not follow, even should these facts be admitted, that the diseases are the same; for it may be readily conceived that a disease, received from man into the system of an animal of a different species, shall be so far modified as to be essentially distinct in its nature; and the symptoms and course of cowpox, even omitting its incommunicability through the air, are so different from those of smallpox that the two cannot be confounded.*

Symptoms, Course, &c.—Very soon after the insertion of the matter, a little inflammation arising from the puncture may generally be seen in the spot; but this disappears, and nothing is left but a slight trace of the wound. On the third day, or early in the fourth, a slight elevation is perceptible to the finger, and a little redness to the eye. By the fifth day, a small vesicle has formed, umbilicated at top, and containing a colourless, transparent, and viscid liquid. This gradually enlarges, and, on the sixth day, is generally surrounded by a very narrow circle of redness at the base. On the seventh day, the vesicle is well formed, round, or oval, with a shining silvery appearance. During the eighth day, the hitherto slight border of redness spreads in all directions, forming a circular areola, which increases usually till the tenth day; and the vesicle at the same time enlarges, and becomes turgid with its fluid contents, especially at its circumference. The disease is now at its height. The pock is usually about one-third of an inch in diameter, between one and two lines in height, umbilicated at top, with frequently a minute scab or brownish scale in the centre, elsewhere of a pearly appearance, firm to the touch, and adherent to the skin. The areola is usually two inches or more in diameter, though varying with the age of the patient, is generally somewhat hard and swollen, and, when examined with the aid of a microscope, exhibits numerous minute vesicles upon the surface. There is usually at this period an uneasy feeling of burning, itching, and tension; and the patient, if a child, is apt to be restless and fretful. On the eleventh day, the disease begins to decline. On the twelfth, the scab has considerably extended over the top, the areola has become faint, and liquid taken from the pock is opaline, and somewhat turbid, and has lost much of its viscidity. On the thirteenth day, the matter is quite purulent, and, instead of being contained in distinct cells, as at first, is all collected in a single small cavity. On the fourteenth, the areola has become nearly if not quite invisible, and the pock has completely dried into a yellowish-brown scab. This gradually hardens, assumes a darker colour, becomes more prominent, and, near the end of the third, or during the fourth week, separates from the skin, leaving an oval or circular scar, which is at first deep and red, but in the end rises nearly to the level of the skin, and becomes white. The surface of the scar is characterized by numerous little depressions, probably corresponding with the cells of the vesicle.

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* It was an easy inference from the modifying influence of the system of the cow on the variolous contagion, that a similar effect might be produced by the *milk of the cow* on smallpox matter; and M. Theile, of Kassan, and M. Robert, of Marseilles, proposed the use of such a mixture in vaccination. M. Brachet, of Lyons, in the year 1832, made some experiments with satisfactory results; and these have been recently repeated on a much larger scale at *La Charité*, in Lyons, by M. Bouchocourt. Equal parts of cold milk and variolous matter taken from the pock in the vesicular stage were mixed, and three children inoculated with the mixture. Others were inoculated from matter proceeding from the vesicles thus produced, and others again from these secondary cases. Of 21 cases, 18 presented solitary vesicles confined to the place of puncture, having all the characters of genuine vaccine disease, and the three others but a few additional pocks. The inoculation thus performed proved protective. (See *London Med. Times and Gaz.*, April, 1854, p. 412.)

From the eighth to the tenth day of the eruption, the constitution appears often to sympathize with the local affection, and a moderate febrile movement takes place. The glands in the axilla are often also swollen and painful. These symptoms soon subside, without leaving any unpleasant effect.

The course above described is that generally followed by the vaccine disease; but it is liable to great diversity. The degree of severity is very different in different cases. Sometimes the complaint is exceedingly mild, with a small vesicle and areola, and without pain in the axilla or fever; in other instances, along with considerable fever, the local affection is very severe; the areola extending further than usual, sometimes over nearly the whole arm, or even beyond it, with much swelling and pain, and assuming almost the character of erysipelas; while the axillary glands are much inflamed, and sometimes, though very rarely, suppurate. This severity is much more frequent in adults than children. The affection is almost always mild in infants, when ordinary matter is used. Sometimes the extension of the inflammation is ascribable to the too great number of insertions, made at such distances as to insure separate pocks, the areolæ of which coalesce.

There is great difference also in the relative duration of the different stages, and in the whole duration of the complaint. The period of incubation, or that which intervenes between the insertion of the matter and the first appearance of the pock, is sometimes greatly lengthened; extending to one, two, or three weeks, or even more, instead of two or three days. Occasionally the matter appears to lie dormant, until excited into action by some new cause, as by another insertion; after which the two portions appear to act together, and the local affections march on, with equal pace, in the two positions. The period of maturation is also sometimes lengthened. In some instances, the whole process is shortened, and the affection runs through all its regular stages in seven days.

Various anomalies, moreover, now and then occur in the developement of the local and general affection. Thus, it occasionally happens that there is no areola, or only a very narrow rim of redness about the base of the pock, and more frequently, that the areola is irregular in its form. The efficacy, however, of the vaccination does not appear in any degree diminished. Sometimes, instead of the vesicle, there is nothing but a raw or ulcerated surface of the same size, surrounded by the areola. This is said to occur especially in scrofulous subjects. I have witnessed such cases, and, upon subsequently testing them, have found the system equally protected as by the disease in its ordinary form. Occasionally the vesicle is broken by accident, and a suppurating sore produced; and the experiment has been tried of destroying it in its early stage, by means of nitrate of silver. In either case, it is asserted that the protective influence of the disease is not interfered with. There is even good reason to believe that a vaccine fever, perfectly protective against smallpox or revaccination, sometimes appears about the eighth day after vaccination, without any vesicle whatever; though such a case has never occurred to me. Occasionally cases are said to occur in which other vesicles arise at points where no matter was inserted; and an instance is recorded by Dr. R. O. Clark, in which there was no appearance of a pock at the point of insertion, but one regular in all its characters showed itself in the other arm, and proved quite protective. (*Lond. Med. Gaz.*, Nov. 1850, p. 788.)

In all the above varieties, the disease may be considered as genuine. But sometimes a spurious affection results from vaccination, which affords no protection against smallpox. This generally arises from the use of bad matter; but it not improbably also results, in some instances, from peculiarities in the constitution of the patient. There is little difficulty in distinguishing these cases. The inflammation almost always commences earlier than the genuine, sometimes almost immediately after the operation. The vesicle or pustule is fragile, breaking easily, and forming a soft yellowish crust, which separates upon the fifth or sixth day, sometimes leaving an ulcerated surface, which may be obstinate. The pock, in these cases, is conical and somewhat pointed, not cylindrical and umbilicated. The vaccination of those who have previously had the cowpox, or smallpox, also gives rise to anomalies, which will be noticed under the head of revaccination.

Anatomical Characters.—When the vaccine vesicle is dissected, upon the eighth or ninth day, there may be perceived, according to Gendrin, at the umbilicated depression in the centre, beneath a scale of the cuticle, a minute portion of pus, the quantity of which is proportionate to the extent of the wound made in the operation. When this is removed, the whole vesicle has a uniformly shining and silvery appearance, and, upon being opened, is found to contain a limpid fluid in small cells, arranged in two concentric rows, and formed in a pseudo-membranous product, which has been thrown out between the true skin and the epidermis. Gregory states that the number of these cells is from ten to fourteen.

The limpid vaccine fluid which begins to form, on the fourth or fifth day, in the cells of the vesicle, is colourless, very viscid, and inodorous, drying on exposure to the air without losing its transparency, adhering to objects upon which it may be placed, readily soluble whether liquid or concrete in water, and, if excluded from the air, capable of being long kept without change, though slowly decomposed upon exposure to the air, especially in warm weather. A considerable degree of heat decomposes it quickly, and it is said to be rendered inert by extreme cold. On the tenth day of vaccination, the liquid is less viscid, somewhat turbid and opalescent; and is said to be mingled with some pus. On the thirteenth day, the characteristic lymph appears to have been wholly consolidated, and nothing is left but purulent matter contained in a single cavity.

I have, contrary to the usual practice of recent writers, denominated the pock a vesicle. It remains vesicular so long as it retains its peculiar character, and until it begins to decline; and the pus that may be present is probably not the result of a change in the original lymph, but of a distinct action, and does not appear to have the property of communicating the disease.

Susceptibility to the Disease.—This is very different in different persons. Some resist the disease altogether, though not previously protected in any known manner. However frequently the operation for vaccination may be performed on them, no effect is produced. Such cases, however, are very rare, and I do not recollect that one has ever occurred to me.* It is by no means uncommon to resist the first insertion of the virus, or even several insertions; but generally the individual becomes affected at last. There appears to be occasionally a want of susceptibility from some temporary cause; and the operation which may have often failed at one period, will, upon being repeated at an interval of some weeks or months, readily succeed. Failures are often owing to defect in the virus, or imperfect insertion; but, making all due allowance for these, we must admit that the fault sometimes lies in the condition or constitution of the person operated on. It is asserted that infants, immediately after birth, are less susceptible of the disease than when at the age of a month or six weeks. Rayer states that the operation fails twice out of three times, in infants three or four days old. It has been supposed that various other diseases materially affect the susceptibility to the vaccine, and modify its character. Dr. Jenner believed that certain eruptive diseases might so far modify it, as to interfere with its protective influence. M. Taupin, who vaccinated more than two thousand children in the *Hôpital des Enfans* at Paris, under every variety of circumstances, and while under the influence of all the different diseases to which the inmates of that infirmary are liable, observed that the vaccine disease was in no respect modified by diseases unattended with fever, except that the local affection was less active in persons of feeble constitution; that it was very slow of developement in advanced tuberculous affections, and ran through its several stages also slowly; that in typhoid fever, and severe inflammation of the viscera of the chest, the developement of the vesicle seldom took place, except in the decline of the disease; that a similar influence was not exerted by cerebral inflammation; that, in the febrile eruptive diseases, such as scarlatina, measles, roseola, urticaria, and pemphigus, the vaccine complaint was always retarded when the operation was performed in their initiatory stage, and, if either of these diseases supervened upon vaccination, was suspended until that disease had run its course, and then resumed its march. (*Dict. de Méd.*, xxx. 406.)

Protective Power.—The vaccine disease owes all its importance to the protection which it yields against the attack of smallpox. Dr. Jenner went so far as to express his belief, that it might become the instrument of extirpating that loathsome and destructive disease from the earth. This is probably going too far; for it is impossible to say that smallpox is not frequently springing up anew, independently of contagion; and it is not possible to secure every inhabitant of the earth against it. But this far we may go, that vaccination affords the best attainable security, greater even than that accruing from a previous attack of smallpox; and that, with due care, it will serve as an effectual safeguard in individual cases, almost without exception.

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* Similar cases have occurred resisting the influence of the smallpox virus. In relation to some of them at least, it is highly probable that the child owes its insusceptibility to having been affected with smallpox or vaccine disease received from the mother before delivery. Dr. S. F. Parker records a case in which such protection appeared to be afforded by smallpox in the mother (*Bost. Med. and Surg. Journ.* xliv. 441); and Dr. W. T. Taylor another in which the same protection seemed to result from a previous vaccination of the mother. (*Am. J. of Med. Sci.*, N. S., xxvi. 129.)

It was formerly supposed that a single successful vaccination would prove, for all time, a certain preventive of smallpox; and the result appeared for many years to justify the opinion. Thousands upon thousands were tested in various ways after vaccination, and the protection so uniformly proved effectual, that scarcely a doubt was left upon the mind of the most skeptical. The few variolous cases that occurred after vaccination were ascribed to some defect in the operation, or some interference with the course of the vaccine disease by other morbid processes. But the occurrence of the variolous epidemics which began to make their appearance in Europe in 1818, and in the United States in 1823, and in the course of which great numbers of the vaccinated suffered more or less, tended very much to shake the confidence of the profession; and there were many who abandoned their faith in the protective virtues of cowpox altogether. It cannot now be denied that a single vaccination does not afford the permanent security it was supposed to do. Probably, nearly one-half of those vaccinated successfully are liable to more or less effect from the variolous contagion; though it is asserted that, when the operation is performed with four or more insertions instead of one, the proportion of the protected is much greater. (*Medico-Chirurg. Trans.*, xxxvi. 388.)

It is chiefly during the epidemic prevalence of variola, that this disposition in vaccinated persons to be affected by the disease is observed. It has very seldom been noticed to any considerable extent at other times. Another interesting fact is, that children of eight years or under are rarely attacked, that from this time to the age of puberty cases begin to be more frequent, and that the greatest number occurs between the ages of fifteen and twenty-five. These two facts it is important to bear in mind.

But, though vaccination, once performed, very often fails of affording complete protection against smallpox, yet it almost always modifies it very greatly, rendering it a comparatively mild and safe disease. The modifications thus produced have been already treated of under the head of *varioloid*. It is sufficient here to state that the complaint, as it occurs after vaccination, is very seldom fatal, and, in the vast majority of instances, leaves no unpleasant traces behind it. Though the cases of varioloid or secondary smallpox, occurring after a previous variolous attack, are proportionally less frequent than those which follow vaccination, yet they are not only proportionally, but in the aggregate, also, more fatal. Thus, of 484 cases of varioloid after vaccination, reported by Dr. Thomson, of Edinburgh, only one proved fatal; while of 71 of secondary smallpox three died. Of 248 cases of natural and modified smallpox noticed by Drs. Bell and Mitchell, of Philadelphia, 64 were after vaccination with but one death, and 16 were after inoculated or natural smallpox with six deaths. In the course of my practice, though I have seen much of the disease, I have lost but one patient after vaccination; and in that instance death occurred, not from the violence of the varioloid disease, which was mild, but from the supervention of inflammation of the brain, consequent on the peculiar state of the patient's constitution at the time. Thus, it appears that, if the protection afforded by vaccination is not perfect, it is yet superior to any other.

If one vaccination does not completely protect against varioloid, neither does it against the vaccine disease itself. A second vaccination sometimes fails entirely; very often produces a modified cowpox, which bears about the same relation to the genuine that varioloid does to variola, and might very properly be denominated vaccinoid; and, in a few instances, gives rise to a vesicle, which can in no respect be distinguished from the genuine. I think I have observed that a second vaccination is most effective in seasons when variolous epidemics prevail; and there is a remarkable coincidence between the vaccinoid and varioloid affections; so that the inference is perhaps justifiable, that, when a patient takes the vaccine disease a second time, he would have been more or less affected by the contagion of smallpox, had he been exposed to it. In relation to the proportion of those capable of receiving the vaccine disease more or less perfectly a second time, the annual reports of revaccinations performed in the Prussian army are highly interesting. About 40,000 soldiers have been annually revaccinated for several years; and, from a comparison of all the results, it appears that in about two-fifths of the cases "regular pustules" were produced, and in about one-fifth more "irregular pustules;" while in the remainder there was no effect whatever. If, by the regular pustule, is here meant the vaccine vesicle in its legitimate form and course, as before described, these results are very extraordinary, and far beyond anything seen in this country. If a wider extension be given to the word regular, they may not differ greatly from the effects observed among us. At all events, a singular relation is here exhibited between the proportion of persons subject to the vaccinoid disease, and of those supposed to be liable to the varioloid, which has already been stated at about one-half of the vaccinated.

The question may be reasonably asked, how it happens that the protection afforded by vaccination against smallpox is less complete than formerly. Is it owing to the wearing out of the influence of vaccination by time? Some suppose so; and they support their opinion by appealing to the fact, that children under eight years are seldom attacked. It is inferred that the preservative influence lasts about seven years. But the conclusion is not justified by the facts of the case. In the first place, it does every now and then happen that children under eight years old are attacked. Besides, vast numbers have been vaccinated at ages much beyond infancy, and it has not been observed that in these, the susceptibility to the disease returns in seven or any other given number of years. Besides, if the gradual failure of the vaccine protective influence were the law, it ought to be more general. It ought not to happen that about one-half of the vaccinated should be permanently protected, as is known to be the case. Finally, if there were such a supposed gradual wearing out of the vaccine influence, we ought to find the varioloid more and more readily produced, and more and more severe, the further it is removed from the period of vaccination, until at length it should be undistinguishable from the smallpox. Such is not the case. On the contrary, the susceptibility to the varioloid appears to diminish after the twenty-fifth year of life. The probability, therefore, is, that the supposed wearing out of the vaccine influence is imaginary. The original question then recurs; what can be the cause of the insufficiency of protection in certain cases? It may, I think, be explained by recurrence to two of the facts stated some time back; namely, the greater tendency to varioloid during the epidemic prevalence of smallpox than at other times, and its greater frequency between the ages of fifteen and twenty-five than at any other period of life. Thus, the security afforded by the vaccine disease or smallpox, occurring in seasons when no epidemic influence exists, may be effectual under similar circumstances, but may fail during an epidemic, when other forces are added to that of the contagious cause. Hence the occurrence of varioloid abundantly in Philadelphia in 1823, though it had been previously unknown, when no epidemic influence existed. That persons are most liable to the affection between fifteen and twenty-five would seem to show that the changes which take place about the period of puberty, and continue in operation more or less until that of full maturity, which may be roughly placed at 25 or 30, are favourable to the developement of variolous disease; and that a degree of protection which might be sufficient either earlier or later in life is insufficient then.*

But, whatever may be the cause, the fact is certain, that one vaccination fails to afford security against a modified form of smallpox in very many cases; and, though the resulting affection may be in general neither fatal nor deforming, yet it is inconvenient, may become the source of a further spreading of the disease, and in some cases is very dangerous. It is important to find a remedy for these evils; and happily such a remedy is afforded in revaccination.

It is an important question, how far vaccination, performed after exposure to the cause of smallpox, is capable of preventing its occurrence, or modifying its course. So far as my observation has gone, and I believe the same result has been obtained by others, if the vaccine virus be inserted so early after exposure that the vesicle shall appear before the variolous fever has occurred, the smallpox will either be prevented altogether, or will be so far modified as to be harmless. Two cases which happened to me will illustrate this point. An infant at the breast of its mother, who was covered over with variolous eruption, was vaccinated before any appearance of the smallpox had been presented. The vaccine disease pursued its regular course, and reached its height on the ninth or tenth day; about which time some fever was observed, followed by a few abortive variolous pustules, which soon dried up without maturing, or producing any untoward symptoms whatever. A student of medicine, who had been exposed to variolous contagion, was vaccinated successfully, and just as the vaccine vesicle approached maturity, was attacked with fever followed by a moderate eruption, which dried up about the fifth day. The inference is, that vaccination should always be resorted to as soon as possible after exposure, provided the smallpox has not already commenced. It has even been asserted that, if vaccine virus be freely introduced into the variolous eruption when it first shows itself, the latter will become abortive; but experiments have not confirmed this statement.

Effects upon other Diseases.—The vaccine disease has been thought to have the power of modifying other diseases favourably, and even of superseding them. It certainly appears occasionally to set aside obstinate cutaneous eruptions. It is said to have cured various chronic inflammations, such as ophthalmia, otitis, and bronchitis. In hooping-cough, it was at one time supposed to act as a remedy; but faith in its influence over this disease has been lost. It has been employed to destroy certain erectile tumours, through the inflammation produced by the insertion of the virus; and my preceptor, the late Dr. Joseph Parrish, once employed it, with some apparent effect, in order to induce an external direction to scrofula, by inserting the lymph abundantly in the vicinity of the cervical glands. The prejudice has prevailed, to a considerable extent, that it is apt to leave a disposition to cutaneous eruptions behind it. The fact appears to be, that a lichenous, roseolous, or eczematous eruption sometimes attends the maturation of the vesicle; but this is temporary; and the eruptions that occasionally take place afterwards are probably those which are incident to childhood, and have only an accidental relation with the vaccine disease.

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* In the report by Dr. F. W. Sargent of cases attended in the Philadelphia City Hospital, in 1845–6, it is stated that of the cases of varioloid or smallpox after one vaccination, amounting to 136, more than twice as many occurred in the ten years from 19 to 29 inclusive, as in either of the ten years preceding or following those ages. (*Am. J. of Med. Sci.*, N. S., xvii. 372.)

Vaccination.

I shall treat of this, *first*, in relation to those upon whom, and the time when, it should be practised; *secondly*, in relation to the matter to be employed; and *thirdly*, in relation to the mode of performing the operation.

1. *Persons to be vaccinated.*—As new-born infants are comparatively insusceptible of the disease, in consequence possibly of the undeveloped state of their skin, the operation should generally be deferred till the sixth week or later. The third or fourth month is perhaps a still better period. It is best, under ordinary circumstances, to vaccinate only those in good health. Yet, in cases of urgency, as, for example, during the prevalence of a variolous epidemic, and especially when the individual has been exposed, or is likely to be exposed to the contagion, these precautions may be neglected, and the operation performed at once. It is easily repeated afterwards, should the vaccine disease not prove satisfactory. No particular preparation is in general required. In adult cases, however, when a plethoric or inflammatory condition of system is obvious, it may be proper to give the patient a saline cathartic, and to put him upon a reduced diet, after the insertion of the virus. It is said that the operation is more apt to fail in extremely hot, or extremely cold, than in moderate weather. It should be performed preferably in spring or autumn, other things being equal.

2. *Matter employed.*—The lymph taken from the vesicle on the fourth or fifth day is said to be most efficient; but it retains its virtues, little impaired, till the eighth or ninth day. After this period it deteriorates, and, if taken on the eleventh day or later, is said seldom to succeed. Infantile virus is asserted to be stronger than that of adults. When several are vaccinated from the same vesicle, those are most apt to receive the disease who come first in order.

The scab is certainly efficacious, and in this country is almost exclusively employed. It is, perhaps, rather less certain than lymph directly from the vesicle; but this is often difficult to be procured, and the scab keeps better than the dried virus in any other shape. I have used it from the commencement of my practice, and remember only two instances in unprotected persons, in which I did not sooner or later succeed with it. The scab retains its virtues for months, if preserved in a cold place; and, if at the same time excluded from the air, often continues efficacious for a year or more. It should not be carried long in the pocket, nor kept in a warm room, as it is readily decomposed by heat. When it is important to preserve it long, the scab should be thoroughly dried, then wrapped closely in tinfoil, and well coated with wax. A coating of collodion has also been recommended, in order to protect it from the air. It should be umbilicated, of a reddish-brown or garnet colour, translucent, and brittle when dry. The advice has been given to reject a thin scale formed by the drying of the pus, in the middle of the scab. In Europe, much prejudice appears to exist against the scab, which is certainly the most convenient form in which the matter can be kept, and has been found to answer every desirable purpose. In the few cases in which it fails, recourse may be had to lymph from the vesicle.

Various means of preserving the lymph have been resorted to. Sometimes it is placed, in the liquid state, between two smooth pieces of glass, where it hardens. Sometimes it is introduced into fine tubes of glass, which are then hermetically sealed. Again, threads are moistened with it, then dried, and kept in closed tubes. It is also occasionally collected on the points of lancets, where it is allowed to harden.

In selecting matter, that should be preferred which comes from a healthy individual. Nevertheless, repeated trials appear to show that the character of the virus is not affected by any coexisting disease. The following is given as the result of the experience of M. Taupin, who has had extraordinary opportunities for ascertaining the truth. "The matter taken from children affected with acute or chronic diseases, with essential fevers, typhoid affections, eruptive fevers, thoracic, abdominal, and cerebral inflammations, the neuroses, such as chorea, hysteria, epilepsy, &c., was as energetic as if drawn from healthy children, gave rise to as copious and regular a vaccine disease, was as efficacious against smallpox, and transmitted no disease whatever, whether acute or chronic, contagious or non-contagious." (*Dict. de Méd.*, xxx. 414.) A singular fact, also stated by M. Taupin, is, that he had on several occasions employed virus taken from children after death, but had uniformly failed, though the same cases were afterwards successfully vaccinated. (*Ibid.*) A mixture of the vaccine and variolous poisons is said sometimes to produce only one disease, sometimes both, which afterwards run distinct courses.

The notion has been widely prevalent, that the vaccine matter has become deteriorated by frequently passing through the human subject. I believe, however, that there is no ground for this opinion. It is true that matter derived immediately from the cow is more powerful, and generally produces more inflammation; but there is no proof whatever that its preventive influence is in any degree the greater on this account. It is said that this greater power is speedily lost by the passage of the virus through a few successive individuals. I have been in the habit of vaccinating, and of witnessing vaccination, for more than thirty years; and, within my remembrance, there has certainly been no material change in the appearance of the local affection, as we ordinarily perceive it, or in the constitutional symptoms. If the virus has deteriorated, those recently vaccinated should be affected with varioloid more frequently and severely than those long vaccinated, which is certainly not the case. In consequence of the notion just combated, recourse has occasionally been had to the cow afresh; but I believe unnecessarily; and if Jenner's opinion is true, that there are several diseases to which the cow is subject, which may be mistaken for the genuine, there may be some danger of evil consequences. A few years since, some matter was brought from Europe to this country, said to be extraordinarily efficacious. It produced, however, such violent inflammation and extensive sores, that physicians became alarmed, and I believe generally abandoned it. There is reason to believe that such matter is less efficient, as a protective agent, than that ordinarily used.

There would be some hazard, in the present state of our knowledge, in employing the virus which has been converted from variolous to vaccine by passing through the cow. It was stated, in most of the memoirs presented to the French Academy for their prize, that the disease produced in the cow by vaccination with ordinary vaccine matter from the human subject, is of the same mild character as in man, and that the virus undergoes no change. Others, however, came to a different conclusion; and the fact, that the matter is rendered more powerful by passing through the cow, is inferrible from thousands of experiments made in Bavaria, by direction of the government. (*Watson's Lectures*, 2d Am. ed., p. 1011.)

3. *The Operation.*—The most convenient place for the insertion of the virus is the back of the forearm, about half-way between the hand and elbow. The vesicle is in this situation least likely to be interfered with in nursing, or to be injured by tightness of the sleeves. In females, however, it is customary to

vaccinate on the outer part of the arm, near the insertion of the deltoid; the object being to avoid an unsightly scar, in a part of the arm likely to be exposed.

The plan of operation which I learned from my predecessors, and have uniformly pursued, is first to reduce the matter, if solid, to the consistence of pus, with water, upon a piece of glass; then, taking a little upon the point of a lancet, and holding the arm in the left hand so as to render the skin somewhat tense, to make three slight punctures obliquely under the cuticle, and gradually to work in the matter, till none is left on the lancet, or the surface of the skin. The punctures should be about a line apart, and at the three angles of an equilateral triangle. This number generally insures success, one taking, if the others fail; while, even if all are effective, only one pock results. Care should be taken not to draw much blood, as it is apt to wash out the virus. It is sufficient that a tinge of blood should be seen in the punctures. I have generally preferred a lancet not very sharp, as we are thus enabled to penetrate some distance under the cuticle, without causing the flow of blood.

Various other modes of operating have been recommended. I shall refer only to one in considerable vogue, which consists in making several minute superficial incisions, crossing each other, with a very sharp lancet, and then applying the matter to the wounded surface.

It has been recommended, when the skin is hard, to soften it with an emollient poultice before operating; and, when pale and inactive, to excite it by friction. These measures may be resorted to in cases of failure.

If not successful at first, the operator should make repeated trials, and, failing with matter from the crust, should have recourse directly to the vesicle. Sometimes he will succeed by postponing the second operation for some weeks or months.

Should doubt from any cause exist as to the genuineness of the disease, a good plan of testing it is to introduce a portion of virus into the other arm about the fourth or fifth day. If the disease is genuine, the new vesicle formed will correspond in its course with the original, and arrive at its height at the same time, though it will usually be smaller. If the second vaccination is performed after the sixth day, it is asserted that it fails altogether, because the system becomes by this time protected against a new impression, whether from vaccine or variolous matter. Should the test just mentioned fail, or not be resorted to, revaccination should be employed immediately, in all doubtful cases.

Treatment.—In general, little or nothing is required. Should the fever be high, and the local inflammation considerable, a saline cathartic may be given, the patient placed upon a vegetable diet, and cold water or lead-water applied to the arm. Cases sometimes occur in which the loss of a little blood from the arm is advisable; but they are rare. Great care should be taken, in the progress of the disease, that the vesicle is not broken, or otherwise injured.

Revaccination.

This operation should be employed in every case which has not been tested by exposure to smallpox contagion, during an epidemic prevalence of the disease. The following are the reasons for this advice. 1. There can be no certainty that an individual, only once vaccinated, may not have an attack of modified smallpox on exposure; and, though the attack will probably be moderate, no one can predict, with confidence, that it may not be severe and even dangerous; and, at all events, it will be worse than a revaccination. 2. Abundant experience has shown that a second vaccination, properly timed, is capable of supplying any deficiency of protection left by the first, in the vast majority of cases. I have been in the habit of revaccinating for about thirty years; and, during that time, have seen no decided case of varioloid in any one that

I have revaccinated, unless the patient had been exposed to the contagion of smallpox, and received it in his system before the operation. Even in such cases, the varioloid has been developed in but a very small proportion of them, and in these very mildly. A few instances of the efficacy of the plan, selected out of a great number, may tend to enforce the precept. In 1828, a patient, the father of a large family, fell ill of a secondary smallpox, and died. The house was full of persons of various ages, children and adults. They were all revaccinated, and not one had any symptom of smallpox. But in a family next door, in whom the operation was not performed, several were attacked with varioloid. About the same time, all the inmates of the institution for the deaf and dumb in this city, amounting to about seventy, were revaccinated; and, though an epidemic smallpox was raging at the time around them, only two or three mild cases of eruption occurred, which might well have been owing to previous exposure. In the winter of 1845–6, a student of medicine died of confluent smallpox in a boarding-house, containing about thirty inmates. All of these were revaccinated, except three young men who had confidence in their security. Those who were revaccinated escaped; while the three persons alluded to were, as I was informed, affected with varioloid.* The experiments made with revaccination in Germany have been so successful as to lead to its very extensive adoption. Of nearly 45,000 soldiers revaccinated in 1841, in Prussia, only eight were attacked with varioloid. "Before the order for revaccination was issued, the different barracks used to be a prey to varioloid disease; it has now, however, disappeared." (See *Am. Journ. of Med. Sci.*, vi. 248.) What possible reason then can there be for not employing revaccination universally? It can do no harm, and may secure from a loathsome, if not dangerous disease.† That in some very rare instances the smallpox, or some modification of it, has followed revaccination, is no argument against it. The susceptibility in some individuals is so great that no means of prevention appears sufficient to extinguish it, and cases have happened in which smallpox itself has recurred even a third time. Some caution should be exercised in relation to the revaccination of pregnant women; and, during the prevalence of epidemic erysipelas, the operation should be postponed unless imperiously called for, as it has been occasionally followed by an attack of that disease, under such circumstances.

Other cautions also may be useful. As an increased susceptibility seems to be acquired after the eighth year of life, and especially about and subsequent to the age of puberty, it will be proper not to revaccinate, unless to ward off immediate danger, until the fourteenth or fifteenth year. Considering, moreover, that the varioloid is much more apt to occur during variolous epidemics than at other times, it will always be advisable to seize those occasions for revaccination. The efficacy of the resulting vaccinoid disease will very probably be greater, when the influence of the epidemic thus co-operates with that of contagion. It seems rational to suppose that vaccination also, at these seasons, would yield a more complete protection than when not aided by this additional influence. This, however, is a point for experience to determine.

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* Dr. F. W. Sargent states that, of 287 cases of variolous disease admitted into the Philadelphia City Hospital in 1845–6, in not one had the patient been revaccinated. (*Am. Journ. of Med. Sci.*, N. S., xvii. 369 and 372.)

† Two cases of death after revaccination are noticed in the *New York Journal of Medicine*, for November, 1848, p. 372; one, reported by Dr. Greig, in the *North-Western Med. and Surg. Journal*, of a person aged eighteen, who died eight days after vaccination, of inflammation and mortification of the arm; and the other, by the Editor of the *Ohio Med. and Surg. Journal*, of a child who died with convulsions, twenty-four hours after the insertion into its arm, by the mother, of thick yellow matter from a vaccine pock. Another child of the same parents, vaccinated at the same time from the same matter, was very ill, but recovered. The probability is that, in the first fatal case, the result was owing to some vice of constitution, and might have ensued from a common wound; and, in the second, a poisonous matter was introduced instead of the genuine vaccine virus. Neither case offers any argument against revaccination. (*Note to the second edition.*)

It may be asked, whether vaccination should be employed in persons previously affected with smallpox. I should unhesitatingly answer this question in the affirmative. It has been before stated that, though fewer persons are attacked with varioloid after inoculation or natural smallpox, than after vaccination, yet a greater number perish. The same protection that a second vaccination extends in one case, will probably be extended by vaccination in the other, and is even more needed, at least so far as life is concerned. In a family under my professional care, of which all the younger members were revaccinated, and thus secured, the mother, believing herself safe, in consequence of having had a smart attack of inoculated smallpox in infancy, declined the operation. She was afterwards attacked pretty severely with varioloid, while all the rest of the family escaped. It is generally stated in the books that vaccination after smallpox produces little or no effect. My own observation has been exactly the reverse. I have very often noticed that the local affection closely resembled genuine cowpox, both in its form and the succession of its stages, though there has generally been something which evinced a slight modification. Not unfrequently, the inflammation is much beyond the normal amount. Some years since I vaccinated a lady who had been inoculated in youth. The vesicle ran through its regular stages; but the arm was much inflamed and swollen, and the curious phenomenon was presented of a succession of red circular areolæ between the vesicle and the shoulder.

The effects of revaccination are exceedingly various. Sometimes no inflammation whatever is produced, except the slight degree of it resulting from the puncture. Such cases, however, are comparatively few. In relation to them, there is always some uncertainty whether the matter has been properly introduced, or was sufficiently active; and I should not so confidently rely upon the security of the revaccination, as if sufficient local disease had resulted to prove that the operation was not a failure. In other instances, a local impression is produced, but the resulting pock is quite spurious. On the day of the operation, or the following day, the patient feels an itching at the puncture, and a little irregular tumor is rapidly formed, which is sometimes tubercular, sometimes pustular or vesicular, but generally declines, and begins to dry, upon the fifth day, if not sooner. Sometimes these tumours are attended with considerable inflammation of the skin. In other cases, again, and these are numerous, there is a more or less near approach to the genuine disease; the vesicle being umbilicated, surrounded by an irregular and sometimes greatly swollen and painful areola, and often running on to the ninth or tenth day. Occasionally there is a good deal of constitutional disturbance, with fever, headache, pain in the axillary glands, &c. The matter from one of these vesicles will produce the genuine vaccine disease in those not previously vaccinated, showing a strong analogy to the varioloid, the contagion of which causes smallpox in the unprotected. Yet there is almost always something in the secondary vaccine disease, which distinguishes it from the primary, to the eye of a person accustomed to both.

In concluding the subject, I would again strongly urge the propriety of universal revaccination, as the means not only of promoting the comfort and possibly of saving the life of the individual, but also of preventing the spread of smallpox, and of ultimately eradicating it, if not from the globe, at least from extensive communities.

Article IX.

CHICKENPOX, or VARICELLA.

Syn.—Crystalli.

This is a contagious eruptive disease, in which a slight fever, of short duration, is followed by vesicles which begin to dry on the fourth or fifth day.

Symptoms, Course, &c.—The febrile symptoms usually appear without any observable chill, though in some instances they are ushered in by slight rigors. Along with the heat of skin, there is often headache, and occasionally vomiting. Not unfrequently the fever is so slight as almost to escape notice, and sometimes it is quite wanting. It continues from a few hours to one or at most two days, and goes off with the occurrence of the eruption. This shows itself usually first upon the breast, shoulders, and back, whence it spreads to the scalp, face, and extremities. The face is less affected relatively than in smallpox. The pocks are sometimes numerous, though usually few, and almost always quite distinct. They first appear as small bright-red spots, which quickly become vesicular; and sometimes they seem to break out in that form. The eruption is not unfrequently attended with itching or tingling, which causes the child to scratch and rub the vesicles, and thus to break them, when they often appear as small formless red splotches. The unbroken vesicles are generally from the eighth to the sixth of an inch in diameter, occasionally somewhat larger, rounded at top, transparent, colourless or slightly yellow, and very delicate, so that they are easily ruptured. Sometimes they occur in successive crops for two or three days, and consequently appear in different stages of advancement. As they mature, they become a little yellowish and somewhat opaque, so as, when at their height, on the fourth or fifth day, to have a pearly aspect. At this time they begin to shrink and dry; and, on the sixth day, small brown crusts appear, which gradually harden, and fall off on the ninth or tenth day, leaving the surface slightly discoloured, but not depressed. The last crop is sometimes a day or two later than the first in reaching maturity, and separating. If much irritated, as by scratching or rubbing, the vesicles sometimes become pustular, and then occasionally leave pits. In certain rare cases of what seems to be varicella, umbilicated vesicles appear mingled with the others, and sometimes leave behind them small, round, deep pits. I have considered such cases, when I have met with them, as varicella rather than varioloid, because no smallpox existed to which they could be traced. The *conoidal* and *globular* varieties, of Bateman's synopsis, are probably examples of varioloid.

Cause.—The only known cause of chickenpox is a peculiar contagion, unless we admit that it sometimes originates in an epidemic influence. The contagion is not powerful; and it is doubtful whether the disease can be communicated by inoculation. It is certain that repeated attempts to propagate it in this way have failed; and the cases in which success is asserted to have been met with may very possibly have been varioloid disease, which has often been confounded with chickenpox. One attack protects the system against a second. The disease sometimes occurs epidemically; but whether independently of contagion is unknown. It is confined almost exclusively to children, though not entirely so. Cases have been observed in persons of middle age.

Varicella was for a long time confounded with variola; but the distinction, when pointed out by Heberden and others, was generally recognized. Dr. John Thomson, of Edinburgh, revived the idea of their identity, considering them as different modifications of the same disease, and succeeded in creating doubts in many. But the following considerations are, I think, conclusive against that opinion. Chickenpox often occurs in neighbourhoods where there is no smallpox; and epidemics of the former disease sometimes occur, without a case of the latter. It does not give rise to smallpox in the unprotected, but always to an affection having the same symptoms as the original disease. It occurs with identical characters, and with equal facility, in the vaccinated and unvaccinated, in those who have had and those who have not had smallpox; nor does it afford the least protection against smallpox or vaccination. The whole course of its symptoms is different from that of variola. The pock is essentially different from the variolous. It is a superficial vesicle, situated between the true skin and epidermis, without any pseudo-membranous product, and without any deep-seated disease of the corium.

Diagnosis.—The only affection with which varicella can be confounded is varioloid, in some of its varieties. Indeed, I have occasionally met with cases during the prevalence of smallpox, in relation to which it was impossible to decide, with certainty, whether they were variolous or varicellous. But generally the distinction between modified smallpox and chickenpox is sufficiently obvious. In the former, the fever is more severe and longer continued. The eruption is much later in assuming the vesicular character, is often umbilicated, and often more or less pustular. There is, moreover, a greater elevation, and hardening of the surface in the pimple, and at the base of the vesicle, which is much firmer than that of varicella.

Treatment.—The disease is never dangerous, and almost always so mild as to be quite insignificant. Its chief importance, in fact, consists in the possibility of occasionally confounding it with varioloid. Little treatment is required. In the severer forms of it, a dose of magnesia or a saline laxative, cooling drinks, and an antiphlogistic regimen may be prescribed; and it is advisable, after the falling of the scabs, to immerse the child in a warm bath. So slight is the affection, that it is scarcely ever worth while to use any precautions against its propagation.

Article X.

MEASLES, or RUBEOLA.

Syn.—Morbilli.

This is a contagious febrile disease, characterized by catarrhal symptoms, and the occurrence of a rash upon the skin about the fourth day, without the disappearance of the fever. There is no certainty that it was known to the ancients. The first accurate accounts of it are contained in the Arabian writers. Rhazes described it under a distinct name in the ninth century. It was, however, long and strangely confounded with smallpox by the earlier modern physicians.

Symptoms, Course, &c.—The disease often commences with feelings of lassitude, chilliness, aching in the limbs, &c., followed by frequent pulse, heat and dryness of skin, loss of appetite, furred tongue, occasionally headache, and all the other phenomena characteristic of fever. But, along with these phenomena, and not unfrequently antecedent to them, are the symptoms of irritation of the mucous membrane of the eyes, nostrils, fauces, larynx, &c., such as profuse discharge of tears and suffusion of the eyes, sneezing and coryza, slight soreness of throat, roughness or huskiness of the voice, a dry, hard, and hoarse cough, and sometimes tightness of the chest and dyspnœa. In some instances there is epistaxis, and in some, epigastric pains, nausea, and vomiting. The bowels are usually constipated, but sometimes the reverse. In young children convulsions are not unfrequent, especially during the period of teething. There is every possible grade in the violence of this early stage. Occasionally it exhibits nothing more than the ordinary symptoms of moderate catarrh, with little or no observable fever; while in other cases the febrile action runs very high, and evidences of severe bronchial or pulmonary disease are presented. The symptoms generally increase in severity for two or three days, then occasionally remit, to return with undiminished if not increased force, upon the breaking out of the rash. If the fauces be examined a little before this event, the soft palate and uvula will often be observed to have a punctuated redness. The eruption generally begins to appear upon the fourth day or at the end of it; though sometimes it considerably anticipates this period, and sometimes is postponed even to a week or ten days from the commencement.

The rash occurs at first in minute, red, distinct spots, very slightly elevated, which disappear under pressure. These show themselves first in the face and neck, then upon the trunk, and finally upon the limbs; and there is often an interval of two days between the occurrence of the eruption upon the forehead, cheek, chin, &c., and its completion in the lower extremities. The rash very quickly loses its isolated character, and becomes more or less confluent; arranging itself in irregular clusters, which are occasionally somewhat crescentic, and almost always leave intervening spaces of the skin little if at all affected. It feels slightly rough under the fingers, and, though red, has a somewhat darkish tint. There is, however, great diversity in this respect, the rash being brighter when the fever is high, and usually somewhat more so on the face than elsewhere, probably on account of its great vascularity. In some cases, a more prominent or papular eruption mingles with the rash, in others, minute vesicles are here and there observable. The amount of eruption varies greatly, from a few isolated spots, which are all that show themselves in some cases, to a generally diffused redness which is observable in others. Occasionally, instead of commencing in the face, it attacks first some other portion of the surface, especially if previously irritated or inflamed. In some cases, it does not spread, but confines itself to the circumscribed space in which it first appeared. When at its height, which is usually upon the second or third day of the eruption, it is frequently attended with a troublesome itching and heat of skin. In the fauces, the original punctuated redness now often clusters in irregular patches as on the skin; and red points are often seen projecting above the fur on the tongue.

Neither the catarrhal symptoms, nor the fever, decline on the appearance of the eruption. Sometimes, indeed, they seem to be increased. The eyes are now frequently red, and the eyelids swollen, as well as, in a greater or less degree, the whole face. But if nausea and vomiting, irregular abdominal pains, convulsions, or other signs of nervous disorder have occurred, they often cease when the rash is fairly out. The cough, though still hoarse, now becomes more loose, and a transparent mucus is expectorated. Dr. Gregory states that the catarrhal symptoms, in perfectly regular measles, begin to abate on the appearance of the eruption; and he has seen the "cough cease instantly as if by magic." (*Lect. on Eruptive Dis.,* Am. ed., p. 125.)

About the eighth day of the disease, or the fourth of the eruption, the rash, fever, and catarrhal symptoms begin to decline together. The decline commences in the face, where the redness is often much faded, while it is still bright upon the limbs. In some cases, however, the whole duration of the eruption does not exceed a day or two, and in others is prolonged to a week or more. The red colour gradually gives way to a dirty somewhat yellowish hue; and the cuticle separates in fine furfuraceous scales. But the desquamation is not uniform, being sometimes visible on the face or breast exclusively, sometimes limited only by the extent of the eruption, and, in other instances, wholly wanting. It may continue four or five days before it is completed, and is apt to be attended with itching.

As the fever and eruption decline, the expectorated matter becomes thicker and more opaque; and considerable stress has been laid upon the appearance, which it sometimes assumes, of distinct greenish-yellow pellets, floating, in a flattened form, upon an abundance of glairy mucus, and which is considered as somewhat diagnostic.

Occasionally the pectoral symptoms, instead of diminishing at this stage, which is the regular course, continue and even become aggravated; and auscultation reveals all the signs of an extensive bronchitis, or of circumscribed pneumonia. This is the greatest danger of measles. Instead of bronchial or pulmonary inflammation, a diarrhœa not unfrequently sets in, which, when moderate, may be considered favourable; but is sometimes obstinate and troublesome.

Diversities.—Measles offer numerous diversities besides those already mentioned. The following are most worthy of notice.

1. Owing to internal irritations in different parts, as the stomach, bowels, brain, &c., the eruption is sometimes greatly delayed. Excessive purgation is thought occasionally to have the same effect; as also is anything which greatly debilitates the system, such as copious bleeding, some previous vice of constitution, or a malignant action of the cause. Under all these circumstances, there is occasion for solicitude, and the occurrence of the eruption is sought for, either as in itself favourable, or at least of favourable augury.

The same causes which retard the eruption may cause it to retrocede after having appeared; and a similar effect is ascribed occasionally to the influence of cold. The retrocession is apt to be followed by pains in the bowels, diarrhœa, dyspnœa, coma, convulsions, &c., indicating internal irritations, or by the signs of great prostration. Sometimes the rash returns again spontaneously, with the relief of the alarming symptoms. The retrocession, here alluded to, must not be confounded with that early and altogether favourable disappearance of the rash, which sometimes occurs in slight cases.

A return or exacerbation of the eruption has been noticed, in a few cases, after the period of its normal decline.

2. It is thought that a rubeolous fever sometimes occurs without eruption; though there may be difficulty in proving the fact. It is certain that, in the midst of measles, in the same family even in which several individuals may be affected with the regular disease, cases are occasionally seen resembling it precisely in symptoms, course, and duration, with the single exception of the rash. The inference is at least plausible, that the affections have their origin in the same specific cause.

3. Another affection, occasionally seen during rubeolous epidemics, is an eruption having the characters and course of that of genuine measles, but without fever and catarrhal symptoms. This has been called *rubeola spuria*, or *rubeola sine catarrho*. According to Willan, it has no effect in protecting the system against an attack of the true disease. I have repeatedly observed such an eruption as the result of certain irritating substances taken into the stomach, when measles were not prevalent. May it not have a similar origin when occurring during epidemics of that disease? There is another state, which I believe is more frequent, and probably has stronger grounds to rank with true measles; namely, a fever accompanied by a rubeolous eruption, but without catarrh.

4. Measles occasionally appear of a *malignant character*. Some cases of this kind may be intermingled with ordinary measles, arising from a depraved state of the constitution, a strong predisposition to the typhous condition, or the accidental conjunction of some powerfully depressing cause with the specific cause of measles. But more frequently they are the result of peculiarity in the epidemic influence; and are exceedingly rare in this country. The early stage may not materially differ from that of the ordinary disease, unless in a greater frequency and feebleness of pulse, more dyspnœa or epigastric oppression, and a greater tendency to delirium, stupor, or other nervous disorder. But occasionally the prostrating influence of the cause is felt at the outset, and only feeble and imperfect signs of reaction are witnessed. The eruption is apt to be irregular and partial, appearing and then disappearing; and the rash is often of a livid, purplish, or blackish colour, interspersed with petechiæ, and accompanied with a disposition to passive hemorrhage. The abdominal and cerebral symptoms are those of malignant typhus; and affections of the chest, when they occur, assume that condition of intense congestion, with feebleness of inflammatory action, and distressing insufficiency of function, which mark the pneumonia of the same disease. When the patient survives the immediate danger from syncope, coma, or asphyxia, he is still liable to be carried off by the exhausting diarrhœa, or obstinate bronchial disease which remains. In consequence of the dark colour of the rash, this variety of measles has been called *rubeola nigra* or *black measles*, though the same name might be appropriated to cases of the disease occurring in connexion with purpura or scurvy.

5. Measles are liable to numerous complications. Among these, the most frequent and fatal is inflammation of the different organs. Bronchitis and pneumonia have been already mentioned. Enteritis with diarrhœa is not unfrequent. Ophthalmia is common and sometimes severe. Perhaps the most dangerous complication, when it occurs, is pseudo-membranous inflammation of the larynx. Such cases are almost always fatal; but happily they are rare. The same disease existing in the mouth and fauces is sometimes seen. Rubeola is sometimes associated with other eruptive affections. Thus, it occasionally runs a conjoint course with scarlatina, adding to the danger of that disease by directing its pseudo-membranous tendency to the larynx. A fatal case of that kind has occurred to me. It is said sometimes to exist in connexion with smallpox; though these affections probably more frequently have the effect of temporarily superseding each other, one being checked till the other has run its course, and then resuming its own.

Measles occasionally have the effect of relieving or permanently displacing other diseases, especially certain obstinate cutaneous and nervous affections, among the latter of which hooping-cough may be particularly mentioned. It is, however, much more apt to leave disorders behind it. One of the most common of these is chronic inflammation of the air passages, with hoarseness; and I have known a permanent loss of voice to have its origin in this disease. Other unpleasant consequences are obstinate inflammation of the eyelids, inflammation and suppuration of the ear, swelling of the cervical glands, boils in different parts of the body, and chronic diarrhœa. Measles are also well known to favour the developement of tubercles and scrofulous swellings in persons predisposed to them.

Anatomical Characters.—When measles prove fatal, it is generally in consequence of inflammatory disorganization, the signs of which, therefore, will be found after death. But there is no peculiarity in these signs. When death has resulted from the uncomplicated disease, nothing is found but a general congestion of the internal organs, and especially of the mucous membranes. The blood in the vessels is fluid and blackish; and coagula are not found in the cavities of the heart. Andral and Gavarret found the fibrin seldom to exceed the average of health, and generally to fall somewhat short of it; while the red corpuscles were in most instances above the normal standard. This proves the existence of a febrile, rather than an inflammatory character of the affection.

Causes.—It can scarcely be doubted that there is one specific cause of measles; or that this is generated in the bodies of those affected with the disease, and is capable of acting upon others through the air. It is, therefore, contagious. Some difference of opinion exists as to the possibility of communicating the disease by inoculation. Numerous trials have been made, many of which have been apparently successful, while others have failed. It is asserted that the disease has been imparted by inserting into the skin blood taken from the eruptive spots, lymph from the small vesicles which sometimes exist, and even the tears and saliva. Though the circumstance that these experiments have generally been made during epidemics, when all not protected are liable to the disease, may throw some doubt upon the subject; yet the cases of asserted success are so numerous and varied, as to make the affirmative of the question greatly preponderate in the balance of probabilities.

Though capable of being propagated by contagion, measles prevail much more at some periods than others; probably under a peculiar epidemic influence. Whether this influence is sufficient of itself to produce the disease, or whether it merely acts by increasing the susceptibility to the contagious principle, may perhaps be considered uncertain. If the fact, quoted by Rayer, from an old author, that the disease was not known in the new world until the year 1518, when it was imported from Europe, could be relied on, it would go far to prove that epidemic influence is alone insufficient; but the testimony can hardly be admitted to have much weight; and the very frequent occurrence of the disease, without any possibility of tracing it to personal communication, would lead to the opposite conclusion. Still, there is no impossibility in the production, at once by the human body and by other unknown agencies in nature, of the same identical poison, whatever that may be. The difficulty would be removed one step by admitting the vital organic character of contagions. (See *Contagion*, page 164.)

Cold weather appears favourable to the production of the disease; as epidemics of it are most frequent in winter. They occur, however, at all seasons. No age is exempt from the disease. It attacks the fœtus in the womb, and old persons in their second childhood. Yet it is much more frequent in children than in adults. One reason of this may be a diminished susceptibility; yet a much stronger one is the fact, that most persons have the disease in early life, and can have it but once. There is a very general susceptibility to measles; and there are very few who are not attacked at one period or another of their lives.

Though, as a general rule, measles are capable of being taken but once, instances have undoubtedly occurred, as in all other contagious diseases, in which the same individual has been affected a second time.

The period which intervenes between exposure to the cause, and the occurrence of the disease, is generally thought to be about a week, though it is said to be sometimes considerably shorter, and sometimes as long as two or three weeks. In the inoculations performed by Home, the disease made its appearance upon the sixth day.*

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* From an account by Dr. P. L. Panum of the measles which, in the year 1846, affected more than 6000 of the 7782 inhabitants of the Feroe Islands, and in which unusual opportunities were offered for estimating the operation of the contagious cause, it

Diagnosis.—In the early stage, measles may be readily mistaken for catarrhal fever, though some writers speak of a hard, dry, loud, and hoarse cough by which it may generally be distinguished. There is almost always, however, some uncertainty until the eruption appears; and cases in which no eruption occurs must necessarily be doubtful, especially when the influenza is at the time prevalent, or the changes of weather favour catarrhal affections. The only diseases liable to be confounded with measles, after the occurrence of the eruption, are smallpox, scarlatina, and roseola. In distinct smallpox, the subsidence of the fever is a sufficient diagnostic sign. In the confluent, when the fever persists, there may be some doubt at the moment of eruption; but in measles the rash is less observably prominent and hard under the fingers; and the question is very soon decided by the stationary character of the rubeolous eruption, while the variolous is rapidly becoming vesicular and umbilicated. The diagnosis between measles and scarlet fever will be given under the latter disease. From roseola measles are distinguished by the catarrhal symptoms; but measles without catarrh may be easily mistaken for that complaint; and, in its turn, roseola accidentally associated with catarrh may be mistaken for measles.

Prognosis.—In ordinary uncomplicated measles, the prognosis is almost always favourable. The chief danger is from bronchial and pulmonary inflammation, and the danger is probably greater after the disease has begun to decline than during its progress. The occurrence of pseudo-membranous croup is highly alarming, and very generally fatal. The malignant form of measles is also highly dangerous. Occasionally, too, the patient is carried off by supervening disease of the bowels, or of the brain. The danger is greater in the old than in the young, and in cold than in warm weather; and is aggravated by dentition, pregnancy, and the puerperal state. When occurring in the advanced stages of other diseases, measles are apt to carry off the patient. Among the unfavourable signs are unusual severity and continuance of the early fever, with postponement of the eruption; a sudden disappearance of the rash, in connexion with evidences of internal irritation or great prostration; severe dyspnœa, and other symptoms of considerable pulmonary inflammation; great restlessness, delirium, or coma; a continuance of fever, cough, and dyspnœa, after the regular decline of the eruption; a complete loss of voice with dyspnœa; and evidences of malignancy, such as a weak pulse, a livid colour of the rash, petechiæ, and passive hemorrhage.

Treatment.—In the mildest forms of the disease, nothing more is requisite than to keep the patient on a low diet, attend to the state of the bowels, and prevent exposure to cold and wet. In the management of measles generally, it should be borne in mind that this disease does not bear exposure of the surface to cold as well as either scarlatina or smallpox. The tendency to bronchial and pulmonary inflammation renders caution in this respect peculiarly necessary. But neither should the patient be kept in a hot room, nor oppressively covered with bedclothes. A good rule is to render the air and the covering comfortably warm. Children especially require care; as they are apt to be restless, and to throw off their covering. It is important, therefore, when the air of the chamber is at all cool, to watch them closely, both night and day.

When the case is sufficiently severe for treatment, the proper remedies are saline laxatives; demulcent drinks, such as flaxseed tea, solution of gum

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appears that the period of incubation was almost always thirteen or fourteen days. The same writer concluded, from his observations, that it is probably only after the occurrence of the eruption that the disease is contagious. (*Arch. Gén.* 4 sér., xxv. 451, from *Arch. Physiol. Heilkundes,* t. 11.) *Note to the third edition.*

arabic, infusion of slippery elm, decoctions of the saccharine fruits, &c., to which antimonial wine may be added in small quantities; and, when the skin is very hot and dry, the neutral mixture or effervescing draught, the patient being in this case confined to bed. Should signs of decided bronchitis or pneumonia present themselves, or the laryngeal inflammation be at all threatening, or convulsions with a tendency to stupor occur, blood may in ordinary well developed measles be taken with tolerable freedom; as the complaint generally bears the loss of it well. But no more should be drawn, during the course of the disease, than is necessary to guard against danger from the above causes; as excessive bleeding sometimes interferes with the occurrence of the eruption, or favours its retrocession if already out. The general bleeding may be aided by cups or leeches; and these should be preferred to the lancet in doubtful cases. In infants, it will seldom be necessary to take blood from the arm when leeches can be commanded.

Should the symptoms threaten croup, an emetic of ipecacuanha or tartar emetic, followed by a purgative dose of calomel, and afterwards antimonial or ipecacuanha wine or syrup of ipecacuanha, in small and frequently repeated doses, will generally be sufficient to relieve them; and the same treatment, with the exception of the emetic, may be employed when there is oppression of the chest from bronchial inflammation. The warm bath and warm fomentations, or emollient cataplasms, are sometimes also of advantage under these circumstances.

Opiates are not generally advisable in the early stage; but, when the cough is very troublesome, hyoscyamus may be combined with the expectorants just mentioned.

The eyelids, when inflamed, should be frequently moistened with demulcent liquids, as mucilage of sassafras pith, which may also be used beneficially as a collyrium in inflammation of the conjunctiva.

The same plan should be continued after the appearance of the eruption, and until it begins to decline. If at this period the cough should be troublesome, opiates may be used moderately in connexion with expectorant medicines, such as the antimonials, ipecacuanha, and the syrups of squill and seneka. Should a fresh accession of acute bronchitis, or an attack of pneumonia now supervene, they should be met promptly by general or local bleeding, blistering, and antimonials. The loss of blood is even more effectual in subduing inflammation at this stage than during the eruptive fever, and is quite as well borne by the patient. If these means fail, recourse should be had to the alterative use of calomel with ipecacuanha and opium.

The retrocession of the eruption, and its retardation, occasionally require attention. Unless unpleasant symptoms should exist at the same time, it is best to leave the case to nature; but, when evidences of internal irritation or inflammation, or of considerable depression, are presented, prompt interference becomes necessary; and the object of the practitioner should be to call the disease to the surface. Among the most effectual measures for the purpose is the hot or vapour bath, which is applicable in almost all cases, whatever may be the pathological condition. If it be inconvenient to administer this, hot and stimulating pediluvia may be substituted. If the retrocession has arisen from exposure to cold, warm drinks should be given in addition, as infusion of balm, chamomile, or the dried mints; and, if there be at the same time gastro-intestinal or nervous irritation, without any tendency to stupor, and without any considerable bronchial disease, a full dose of Dover's powder will be useful. Should decided inflammation of the interior organs accompany the retrocession, it may be necessary to take blood from the arm. In certain cases, not attended with nausea, an emetic has sometimes answered an excellent purpose. Should the fault lie in a debilitated state of the system, from excessive loss of blood, a typhous tendency, or other cause, it may be necessary to administer warm wine-whey, and the preparations of ether or ammonia internally, while sinapisms, stimulating frictions, and artificial heat are diligently applied externally. When irritation exists in one of the interior organs, a sinapism or blister over the organ will be advisable.

The convulsions which occur in children, in the early stage, often require nothing more than hot pediluvia, or the warm bath, and sinapisms to the limbs; and, indeed, often subside spontaneously without injury; but, when they are persistent, often repeated, or followed by stupor, in addition to the remedies just mentioned, blood may be taken from the arm or the temples, cold applied to the head, and a dose of calomel given internally. An emetic dose of ipecacuanha sometimes proves very useful. Discrimination, however, is necessary; and the practitioner should endeavour to ascertain, whether the affection may not arise from some source of irritation extraneous to the brain, as the bowels for example, or the gums in dentition. In such cases, the remedies should be directed to the real seat of disorder. In all cases of this kind, bleeding should be employed with a proper caution. In the advanced stages of the disease, when convulsions occur, it is oftener probably from nervous irritation than cerebral congestion or inflammation; and the nervous stimulants, as assafetida, camphor, musk, and sometimes even opium, are more efficient than depletion; but the practitioner must be guided by the symptoms.

Diarrhœa, if moderate, should not be disturbed; but, if profuse, painful or obstinate, it should be checked by means addressed to the existing pathological state of the bowels. (See *Enteritis* and *Diarrhœa.*)

Malignant measles must be treated like other typhous diseases, by tonics and stimulants, a judicious use of laxatives, and, when attended with inflammation, by very cautious local depletion, blisters, and calomel with opium.

The diet, in ordinary measles, should be strictly antiphlogistic throughout the disease. During the existence of considerable fever, it should be chiefly in the liquid form. In cases attended with debility, it may be necessary to have recourse to milk and animal broths.

During convalescence, care should be taken to guard the patient against the cold; and in winter he should not be allowed to leave the house until desquamation has been for several days entirely completed, and the catarrhal symptoms have disappeared.

Friction with fat bacon over the whole surface of the body, as recommended by Dr. Schneeman in the treatment of scarlet fever, has been employed also in measles, with much supposed advantage, by Dr. John Evans. (*St. Louis Med. and Surg. Journ.*, ix. 276, from *Charleston Med. Journ.*)

Attempts have been made to prevent measles by inducing a mild form of the disease by means of inoculation. An instance is quoted by MM. Guersant and Blache, (*Dict. de Méd.*, xxvii., p. 684,) in which the operation is said to have been performed in eleven hundred and twenty-two cases, with liquid taken from the patches, or with a tear of the patient, and failed only in seven out of every hundred. The resulting disease was mild, and in no case fatal. On the seventh day the fever appeared, on the ninth or tenth the eruption, on the fourteenth the desquamation; and on the seventeenth the patient was quite well. Ordinarily measles are so mild as scarcely to call for this mode of protection; but in malignant epidemics of the disease, it might be tried, under circumstances of great exposure.

Article XI.

SCARLET FEVER, or SCARLATINA.

This is a contagious febrile disease, characterized by inflammation of the fauces, and a scarlet rash appearing usually on the second day, and ending in desquamation about the sixth or seventh day.

Scarlet fever was long confounded with measles, and, even when distinctly described, appears, from the names employed, to have been considered merely as a variety of that disease. Ingrassias is said to have been the first to allude to it as a peculiar affection, in a work published in 1556. It was afterwards noticed by Coyttar of Poictiers, in France, and by Morton in England; but Dr. Withering has the credit, among British physicians, of being the first who clearly and fully pointed out the differences between the two diseases, and established the claims of scarlatina to its present rank.

Most authors describe three varieties of scarlet fever, the simple, the anginose, and the malignant, and each of them so precisely, that the student might very readily be led into the error of supposing them to be equally distinct in nature. But the fact is, that, though cases are not unfrequently observed in which the characters of each variety are tolerably well marked, yet it very often happens that they are blended together, so that it would be quite impossible to determine to which of them a particular case might belong. The disease is essentially the same in all its varieties, and produced by the same cause; and there is no better reason for distributing it into different sections than for treating in the same manner most other febrile diseases. I shall, therefore, first describe it generally, and afterwards refer to its modifications.

Symptoms, Course, &c.—Either with or without the ordinary preliminaries of languor, weariness, rigors, and pains in the back and limbs, the fever sets in with a frequent pulse, hot dry skin, flushed face, furred tongue, anorexia, thirst, and great muscular weakness. Sometimes there are nausea and vomiting; sometimes also more or less headache, or other symptoms of nervous disorder, such as restlessness, morbid vigilance, delirium, stupor, coma, or convulsions. In relation to the severity of its symptoms, the fever is of every possible grade, from a mildness scarcely amounting to disease, up to the highest point of violence and danger.

Along with the fever, sometimes beginning with it, and sometimes a little after it, there is almost always more or less irritation or inflammation of the fauces, which, upon being examined, appear red and not unfrequently swollen. The same colour is diffused over the interior of the mouth; and the tongue, though coated with a white, or yellowish-white fur, exhibits projecting red papillæ upon its surface, and is red at the tip and edges.

The rash makes its appearance, in most instances, upon the second day of the fever, often, however, earlier or later, and sometimes at the very commencement, so far as can be determined from the statements of the patient or his friends. It occurs usually first upon the neck, face, and breast, whence it gradually spreads over the trunk and extremities, occupying about twenty-four hours in its diffusion. Sometimes its course is the reverse of that stated. In the beginning, it is in minute red points, which rapidly coalesce in broad patches, and in the course of a few hours generally form a continuous scarlet blush over large portions of the surface. But great diversity exists, in different cases, both in the amount and arrangement of the eruption. Sometimes it is very scanty, presenting only a few scattered points here and there, or some patches of moderate extent; but much more frequently, it covers, in a greater or less degree, the whole body; being either uniformly diffused over the surface, or exhibiting this uniformity in certain parts, while in others it is punctuated or in patches. The redness is usually diffused equably over the face and neck, and appears with great intensity in the flexures of the joints, as in the groins, armpits, and bend of the knees and elbows. In certain cases, in the midst of the general blush, points of a deeper redness are observable. The colour has been compared to that of a boiled lobster; but it is usually, I think, of a darker hue. It disappears under pressure, and returns when the pressure is removed. Whatever increases the general excitement has a tendency to deepen it. Hence, the colour is most intense during the exacerbations of the fever, and is increased when the patient cries, or is otherwise agitated. The reddened surface is smooth to the finger; the rash being in no degree perceptibly elevated. Sometimes, however, it has a rough feel like that of goose-flesh in certain parts of the body, as the limbs and anterior portion of the trunk, in consequence of the enlargement of the papillæ. The skin itself is often slightly swollen, especially in the face, hands, and feet; and the hands are rendered somewhat stiff in their movements. Along with the characteristic rash, may not unfrequently be observed, upon the neck, in the armpit, at the bend of the elbow, &c., a crop of small miliary vesicles, which make their appearance at different stages of the eruption. Minute pimples and pustules sometimes also mingle with it during its decline. The cutaneous affection is attended with a sense of burning, itching, or other irritation, which is sometimes very annoying to the patient, and interferes with sleep.

The fever does not abate upon the appearance of the rash, but continues with various degrees of violence, throughout its whole progress. The pulse is usually very frequent, much more so than in febrile diseases generally of the same degree of violence. It is often 120 or 130 in the minute, and sometimes still more frequent. Occasionally it has considerable force, but this is not its predominant character. The skin is dry and burning hot, and the temperature, as indicated by the thermometer, is not unfrequently 105° or 106° of Fahrenheit, and is asserted to have reached 112°. The highest point, however, observed in the experiments of Andral, and those more recently made by M. Roger, was 41° Cent., equivalent very nearly to 106° F. (*Dict. de Méd.*, xviii. 155.) The fever often has exacerbations towards evening; and is occasionally attended with restlessness or delirium, and sometimes with comatose symptoms. The bowels are generally constipated; but sometimes diarrhœa occurs in the advanced stage. Occasionally also, there is irritability of stomach; but this is not a very frequent symptom.

The affection of the throat, in some cases, never exceeds that already noticed as occurring even before the appearance of the eruption. But very often it becomes the most prominent and distressing symptom, being attended with swelling within and without, painful deglutition, and sometimes impeded respiration. This feature of the disease will be more particularly noticed, in the description of the anginose variety.

The disease attains its height usually from the fifth to the ninth day, when, in favourable cases, all the symptoms begin to decline. The rash fades, the miliary vesicles if present dry up, the heat of skin diminishes, the pulse becomes slower and fuller, the throat affection abates, and the tongue, if it has not previously thrown off its fur, does so now, often, however, remaining for some time reddish, glossy, and with prominent papillæ. Sometimes the amendment is accompanied with a profuse perspiration, or a diarrhœa, which may be regarded as critical; but they are very often wanting.

Desquamation generally begins with the decline of the eruption. Sometimes it is furfuraceous, but frequently the cuticle separates in small scales; and, when it is thick, as upon the palms of the hands and soles of the feet, it occasionally comes away in large flakes. I have known the whole cuticle of the palm and fingers to separate, so as to form a complete mould of the inside of the hand. The process of desquamation is often attended with a very troublesome itching and irritation, and sometimes with much tenderness of the skin. It is usually completed by the end of the second week, though sometimes delayed longer, in consequence of a succession of exfoliations. At this time, if no untoward complication has occurred, the patient may be considered as well, though not yet exempt from liability to unpleasant and even dangerous disease. In many cases of scarlatina, albumen may be detected in the urine a few days after the commencement of desquamation; and, when examined with the microscope, it is found in these cases to be attended invariably, according to Dr. Begbie, with a considerable amount of epithelium of the uriniferous tubules, or other portions of the urinary passages. Of twenty-one cases examined by Dr. Begbie, albumen was detected in all. The quantity was small, and it continued to appear but a few days. (*Ed. Month. Journ. of Med. Sci.*, Jan. 1849, p. 443, and Oct. 1852, p. 323.)

But the course of the complaint is often much less favourable. From the beginning to the close, it is not free from danger. Death sometimes takes place in the first stage, even before reaction, from the overwhelming force of the shock upon the nervous system; and, at any subsequent period, the patient is liable to the same result from coma or other violent cerebral affection, which often leaves no organic trace behind it. Inflammation occasionally attacks some vital part, especially one of the serous membranes, with fatal effect. Disease of the stomach and bowels sometimes carries off the patient; and instances have occurred in which affections of the larynx have been the cause of death. The patient may also sink from debility consequent upon the malignant character of the affection, the occurrence of gangrene of the throat, or the exhausting purulent discharges incident to local affections, which are apt to remain after the proper disease has gone.

Having given this general view of the complaint, I will now invite the attention of the reader to its prominent varieties.

1. *Scarlatina Simplex.*—This is distinguished by the absence of the throat affection. There are only the fever and the rash. Such is the definition of scarlatina simplex; but the fact is, that complete exemption from inflammation of the fauces is very rare; and a moderate degree of it would not be considered as excluding the case from the present category. Redness and some degree of soreness in the fauces are scarcely less common than the eruption itself.

The simple variety of scarlet fever is often very mild. In some cases the patient is not even confined to bed. The first sign of disease which attracts attention is occasionally a scarlet blush upon the face and neck, which is attended with a slight febrile movement, and declines upon the fifth day, or sooner. But in other cases it is much more severe. There is a universal diffusion of the rash, which is of an intense redness, the heat of skin and frequency of pulse are extreme, and not unfrequently a slight delirium occurs, especially during the exacerbations of the fever at night. But, unless from some intercurrent inflammation, or concealed malignant tendency, or dangerous sequela, there is little risk of life.

2. *Scarlatina Anginosa.*—In this variety the affection of the fauces is

prominent. Stiffness of the jaws, soreness of throat, and pain in swallowing are often experienced at the commencement of the attack. The eruption is usually somewhat later in making its appearance than in the simple variety, sometimes occurring on the third instead of the second day. It is also, as a general rule, less copious and less diffused. Sometimes it is confined to a particular part, as the hand and forearm. I have seen it in distinct points, very sparsely scattered over the trunk. Not unfrequently it is in patches, with intervening portions of the skin of the natural colour. But very many instances also occur, in which the rash is nearly or quite general, and as intense and uniform as in the simple. Occasionally, after partially breaking out, it disappears, perhaps to return again after a longer or shorter interval; and this process is sometimes repeated more than once. The fever is ordinarily more severe than in scarlatina simplex, with a more frequent pulse, and a greater tendency to delirium or stupor.

The inflammation of the fauces advances with the progress of the disease; and not unfrequently the eyes are red and irritated, though not usually watery, as in measles. The patient sometimes sneezes, has a dry cough, and a guttural voice; and hemorrhage sometimes occurs from the nostrils. Upon examination of the fauces, the tonsils, uvula, and soft palate are observed to be swollen and of a deep-red colour; and patches of a concrete exudation, resembling false membrane, are generally seen upon the surface of the tonsils at an early period. These patches are of a dirty white, yellowish, or ash colour, and are sometimes very extensive, covering the surface of the fauces, and spreading into the pharynx as far as it can be seen. They are usually soft, so that they may not unfrequently be scraped off with an instrument. Formerly, they were thought to be the surfaces of ulcers, or gangrenous portions of the mucous membrane; but, when removed, they leave the surface for the most part merely reddened, and without organic change. Sometimes, however, they really do cover ulcerated or eroded surfaces, which may even be gangrenous. Occasionally they extend into the larynx, producing the symptoms of pseudo-membranous croup; but this event is very rare. They often impart a very offensive odour to the breath. Along with this interior disease, there is almost always more or less swelling of the external parts, in the region of the parotid and submaxillary glands; and sometimes the tumefaction is very great. It has been supposed that the parotid is the seat of the inflammation; and this may sometimes be the case; but more frequently it is in the neighbouring cellular tissue, or the lymphatic glands. The external swelling is hard and painful, and sometimes prevents the patient from opening his mouth so far as to permit an inspection of the fauces. Deglutition is difficult and painful; and, when attempts are made to swallow liquids, they occasionally return through the nostrils. Sometimes the internal parts are so much swollen as to interfere with respiration. The patient is very much troubled with a viscid mucus, secreted in the fauces, which he cannot well swallow, and finds it difficult to discharge from the mouth. The lips are often cracked, invested here and there with crusts, and painful when parted. Not unfrequently the mucous membrane of the nostrils partakes of the disease; the nasal passages are closed by the consequent swelling, and the crusts which form upon their surface; and the patient is compelled to breathe exclusively through the mouth, producing dryness of the tongue and lips. At a more advanced stage, a yellow and exceedingly offensive liquid is occasionally discharged from the nostrils, which is sometimes very acrid, and excoriates the orifices. A similar secretion from the fauces is swallowed, and probably conduces to the production of the irritation of stomach and diarrhœa, which are occasional features of the disease towards its close. The discharges from the bowels are also sometimes acrid, so as to excoriate the anus. Occasionally the inflammation travels back through the eustachian tube into the cavity of the tympanum. The tongue is apt to lose its fur at an early period, becoming deep-red, smooth and glossy, or somewhat rough with projecting and enlarged papillæ. The incrustations upon the fauces spontaneously separate, or undergo a gradual absorption; and the surface is left red, and sometimes, though not generally, excavated. The fading of the eruption begins a little later than in the simple form; and the fever and sore-throat often continue, in some degree, for a few days after the commencement of desquamation. Sometimes, indeed, when there has been much swelling about the neck, recovery is considerably postponed by the suppuration which takes place; and various secondary affections are apt to occur, which protract the disease, and add much to its danger. Occasionally the symptoms assume a typhous character before the close. This variety of the disease is much more apt to prove fatal than the simple; and, when recovery takes place, it is more frequently after a long struggle in the resistance and repair of organic mischief; but still, in by far the larger proportion of cases, the patient does well, and the disease subsides at the regular period.

3. *Scarlatina Maligna.—Cynanche Maligna.—Malignant Sore-throat.*—The name of malignant scarlet fever is applied to certain cases of extreme violence, in which the system is at once overwhelmed by the force of the disease, or in which the symptoms evince, in the course of it, an extraordinary degree of weakness or depravity. Either the simple or anginose variety may offer this character; the affection of the throat not being essential to the malignancy of the disease, though this part often suffers greatly.

In some instances, the patient is completely prostrated in the very first stage. Now and then, during the prevalence of scarlet fever, cases are met with in which the patient is attacked at once, either with comatose symptoms, or with oppression, faintness, and great anxiety; the pulse being slender, feeble, frequent, and irregular; the surface either cool, or hot in one part and cold in another; the respiration preternaturally slow, or hurried and irregular; the face pale or livid; and the muscles almost powerless. Feeble attempts may be made at reaction; febrile heat may be partially developed to disappear again; and even some violet specks may appear as if they were endeavouring to struggle through the skin. But the resistance of the system soon ceases, and the patient dies upon the second or third day. From a less degree of the above symptoms, reaction may take place, and a low fever may be established, with delirium, stupor, or mental inertness, a feeble circulation, a livid, purplish, or dark-red eruption, petechiæ or vibices, passive hemorrhage, involuntary alvine discharges, and, unless a favourable change is effected, death in a few days.

In other cases, in which there is greater energy of system, or less violence of the cause, the early symptoms are those of the anginose variety. The signs from which malignancy may be suspected, in such cases, are violent initial pains in the loins and extremities, a greater disposition to delirium or stupor, a somewhat weaker though not less frequent pulse, a later appearance of the eruption, which is sometimes postponed to the fourth day, its more reluctant or partial efflorescence, and its tendency to a darker hue. In the fauces, also, the tint of the redness is deeper and more inclining to purple than in the sthenic anginose cases. As the disease advances, the symptoms assume a more decidedly typhous or malignant character. The pulse becomes feeble, and the skin less regularly heated; the eruption disappears, or turns of a livid or purplish colour; petechiæ and ecchymoses occasionally appear; the pseudo-membranous exudation in the fauces is of a more dirty or darker hue, and is sometimes almost black; the whole throat is of a deep-red, approaching to a mahogany colour; true gangrenous eschars and deep ulceration often form, with occasionally considerable destruction of the soft parts; the odour of the breath is fetid; the tongue becomes brown, and, as well as the teeth and lips, incrusted with a dark sordes; blood oozes from fissures in the lips and tongue; the urine is sometimes bloody, and hemorrhage may take place from any one of the mucous surfaces; an exhausting diarrhœa sets in; gangrenous eschars form on the sacrum, hips, &c.; and at length collapse takes place, with sunken features, ghastly expression, a cold clammy skin, a fluttering pulse, and involuntary stools, ending in death towards the close of the first, or in the course of the second week. Sometimes, however, the patient is conducted through all these untoward symptoms; and then, with a shattered system, has not unfrequently to struggle with exhausting abscesses, ulcers, and alvine discharges, which too frequently carry him off, though he may survive even these, and ultimately be restored to health. It needs scarcely be said, in relation to this variety of scarlatina, that there is in nature every gradation of malignancy, from the slightest infusion of it into an ordinary case of the simple or anginose variety, up to its most deadly concentration in those cases which sink under the first touch of the disease.

4. *Scarlatina without Eruption.*—It is certain that cases of fever with sore-throat sometimes occur, during the prevalence of scarlet fever, having all the symptoms, and running the exact course of that disease, whether in its milder or malignant forms, with the single exception, that the eruption is wanting. It is even stated by Willan that such cases are capable of imparting scarlet fever. A singular fact with regard to some of them is, that itching of the skin and desquamation take place at the regular period.

Sequelæ.—Few diseases leave a longer train of evils behind them than scarlet fever. Among the most common and troublesome sequelæ, are the abscesses which form in the vicinity of the parotid and submaxillary glands, and which are often very large and exhausting. Sometimes the copious discharge of pus from these sources is more than the weakened system can bear; and the patient, after having survived scarlet fever, dies of hectic. At the best, they greatly protract convalescence; and the constitution, even after being freed from disease, is long in recovering its wonted strength.

Sometimes an abscess opens into the external meatus, and gives occasion to long continued and exceedingly obstinate discharges of pus from the ear. The same result, with destruction of the bones of the ear, and ulceration of the membrana tympani, sometimes follows an abscess of the cavity of the tympanum. In other cases, the eustachian tube is closed by union after ulceration, or by inflammatory thickening of its coats, so as to occasion hardness of hearing. Similar disease sometimes affects the nostrils, and scarlatina not unfrequently lays the foundation for obstinate ozena. Abscesses occasionally also form in the testis, and in the joints.

Diarrhœa is another not unfrequent consequence of scarlatina, which sometimes proves obstinate, and wears out the remaining strength of the patient, though it generally yields to judicious treatment. The stomach sometimes participates in the disease, and the patient passes from scarlatina into a troublesome and dangerous gastro-enteritis.

In females, inflammation of the vagina, with muco-purulent discharge, is an occasional attendant and sequela of the disease.

The serous membranes are not unfrequently attacked with inflammation, in the progress of scarlatina, or during its decline; and encephalitis, pleuritis, and peritonitis may be added to its legacies. Bronchial disease is less common after scarlatina than measles, though it occasionally happens.

Pain and swelling of the large joints, closely resembling rheumatism, cramp-like pains in the lower extremities, and stiff-neck, are other sequelæ.

But, perhaps, the most serious of all of them is dropsy. The patient is liable to this during desquamation, and for a considerable time afterwards, and the cause of it is by many supposed to be the premature exposure of the delicate skin to cold. I confess I doubt this cause, at least in most of the cases. According to my own observation, dropsy has occurred more frequently after mild than severe cases; and authors generally admit the equal liability of these different grades. It sometimes follows cases in which the skin was but very slightly diseased, and where no exposure to cold can be shown to have existed. It is generally in the form of anasarca, though sometimes of ascites, hydrothorax, hydropericardium, and even hydrocephalus. Heaviness, approaching to stupor, with other signs of cerebral disease, is a not unfrequent attendant on the dropsy of scarlatina. The affection almost always yields to treatment; but is occasionally dangerous when the heart or brain is involved; and is said sometimes to cause death by serous effusion in the submucous cellular tissue of the glottis. I have seen only one fatal case, and in that the heart was affected. The dropsy is generally accompanied with scanty and albuminous urine, and is believed to be dependent on an active congestion or inflammation of the kidneys. It may always be apprehended when, during the desquamative stage of scarlatina, the urine is highly albuminous and much diminished in quantity. A moderate albuminous impregnation, with undiminished secretion, is not to be considered as evincing a disposition to the complaint. The anemic condition of system, which occasionally follows scarlatina, may also occasion dropsical symptoms, in which case the urine may or may not be albuminous. For other remarks on this sequela of scarlatina, the reader is referred to the article on dropsy.

It is said that, in certain epidemics of scarlet fever, dropsy has resulted from exposure to the contagion, without being preceded by the usual symptoms of the disease, owing possibly to the absorption of the poison, and its direct action upon the kidneys. Dr. Copland considers this a peculiar form of the disease, and proposes to call it *scarlatina latens*. The name might, with equal propriety, be applied to those cases of sore-throat and swelling of the salivary glands which occasionally result from exposure to the contagion, without the other symptoms of the disease.

While thus productive of disease, scarlet fever has the credit of sometimes curing obstinate cutaneous eruptions and nervous affections.

Anatomical Characters.—Sometimes every trace of the eruption disappears after death; sometimes remains of it may be seen in purplish or livid spots. Upon cutting into the skin, the reticular tissue is found reddened and injected. I have known the cuticle, after death from a violent attack of scarlatina, to be removable, as after a blister. The redness sometimes also disappears from the fauces, though it often remains if the disease has continued beyond the third day. The concrete exudations are often seen, sometimes extending through the pharynx even to the œsophagus, but very seldom into the larynx. Indeed, the tendency to bronchial and pulmonary inflammation is much less in this disease than in measles. Various interior organs are congested; and, when inflammation of any tissue has supervened, the effects of it are seen after death. Among other parts, the alimentary mucous membrane frequently exhibits signs of inflammation; and, in some cases, the aggregate and isolated glandules have been found enlarged and softened, though in a much less degree than in enteric or typhoid fever. Nor is this phenomenon necessarily associated with the typhous state of scarlatina. The kidneys are frequently found congested or inflamed. Often, when the patient has died early, no lesions of any kind are discoverable, which can explain the result. The blood is in different states in different cases, in some thick, in others watery; in some dark, in others red; in some, finally, liquid, and in others coagulated. From the few observations of Andral and Gavarret, it would appear in life to preserve generally about the mean of fibrin, while the red corpuscles are increased; but a more extensive series of observations is required.

Cause.—The cause of scarlatina is probably specific, and is generally believed to be of a contagious nature. This has been doubted by some, and among them by the late Dr. Dewees, who stated that he had never seen "any decided proof that it had communicated itself in any one instance." The circumstance that one member of a family is usually first attacked, and afterwards others, at an interval of several days, is a strong fact in favour of contagion. The cause generally operates through the medium of the atmosphere. Whether the disease can be imparted by inoculation may be considered doubtful, though cases are reported in which the trial is said to have been made with success.

Scarlet fever frequently occurs epidemically; and there is this peculiarity in the epidemics, that they are often very limited, being confined to a small district of country, a single city, or even one part of a city. It may, perhaps, be questionable, whether the epidemic influence itself produces the disease, or only favours the action of the specific cause. The former is probably true; for cases occur which cannot be traced to communication with the sick, and in which, indeed, such communication could scarcely have happened; as when the disease first appears in a secluded and perfectly healthy neighbourhood.

The epidemic influence differs greatly in its effects in different instances, at one time giving rise to a mild, at another to a violent form of the disease; in some instances imparting to it an inflammatory or sthenic, in others an asthenic or typhous character; and occasionally causing a particular direction of the irritation, sometimes, for example, to the bowels, sometimes to the air-passages, and sometimes with especial violence to the fauces. Thus, in one epidemic the patients almost all recover; and in another great numbers perish. In one, bleeding is well borne; in another it is very hazardous, and the patients die unless stimulated.

Allowing the disease to be contagious, it certainly appears not to be very strongly so; at least there are great numbers who seem to be wholly insusceptible to its cause. I presume that, in this country, there is scarcely a community in which by far the larger proportion of the population does not escape altogether. It not unfrequently happens that only a single individual in a family is affected.

No age is entirely exempt from scarlatina, but children are much more liable to it than adults. Indeed, the susceptibility seems to diminish from the age of ten upwards. (See *Lond. Med. Times and Gaz.*, vi. 334.) Of the adults exposed to the cause few comparatively are attacked; and the instances of the complaint in persons above fifty are very rare. According to my own observation, men are much less frequently affected than women; but this may be owing in part to the greater exposure of the latter to the cause, as in nursing. Persons thus exposed, though they may escape the disease, are often troubled with a greater or less degree of angina. I seldom attend cases of scarlet fever without having sore-throat.

The disease prevails at all seasons. By some writers it is stated that epidemics of scarlet fever are most frequent in the spring or summer, by others in the autumn or winter; and a fair inference is that they occur about equally in both.

As a general rule, the disease occurs but once in the same individual; but exceptions have now and then been noticed, though Willan did not meet with one out of two thousand cases. It is probable that, in many instance in which the same individual is said to have had scarlatina twice, one of the attacks was of roseola.

Whether the contagious property is possessed by the disease throughout its course, or whether only at a particular period, does not appear to have been determined. Some suppose that it is retained by the individual during convalescence, and long afterwards, and that contagion may lurk in fomites for months or years; but these opinions are at best doubtful.

The period of incubation varies from two or three days to two weeks or more. It is probably in general about five days.

Diagnosis.—In the early stage, before the appearance of the eruption, scarlatina may be readily mistaken for many other febrile diseases. The most characteristic symptoms are an extraordinary frequency of pulse, and the appearance of redness in the fauces. After the eruption, one of the complaints with which it may be most easily confounded is measles. From this, however, it may be distinguished by the absence of catarrhal symptoms, by the occurrence of the rash on the second instead of the fourth day, by the characteristic anginose affection, and by the peculiarity of the rash, which is of a brighter red colour, more punctuated in the beginning and more uniform at last, without the clustered or crescentic arrangement of the rubeolous eruption, and without its roughness. Sometimes the two diseases appear to be mingled in the same case, when both are prevalent. The means of distinguishing scarlatina from roseola and erythema will be mentioned under the two latter diseases.

Prognosis.—There is no complaint in which the result is more uncertain than in this. The seemingly mildest cases sometimes assume a most malignant character, and patients suddenly die with profound sensorial derangement, when supposed to be quite free from danger; while, conversely, cases apparently the most desperate sometimes end favourably. Besides, after the case has reached convalescence, even under highly favourable circumstances, there is a liability to serious secondary affections.

There is, in certain individuals, an extraordinary tendency to the most violent and fatal form of scarlatina; and these individuals are often closely related. It not unfrequently happens that two or three children die in one family; and sometimes a whole family is thus desolated, upon the same or successive occasions, though the disease, prevailing at the time, may have no particular malignancy. In such families, the prognosis is always more unfavourable than in others; and special care should be taken to guard them, until the susceptibility may be supposed to have worn out with age.

The disease is generally dangerous in pregnancy, and the puerperal state. Under other circumstances, I have observed that women bear it better than men. In the latter, it is exceedingly prone to a fatal result. The cases in adult men of which I have had any personal knowledge, whether in my own practice or that of my medical friends, have been very few; and nearly one-half of them have terminated unfavourably. Of course, the instances of mere febrile sore-throat, from exposure to the cause of the disease, are not included in this statement.

In judging of the probable result in any particular case, reference should be had to the character of the epidemic. When this is very mild, we may with some confidence predict a favourable issue under apparently favourable circumstances; when otherwise, we should be more guarded.

Among the unfavourable signs are a late appearance, considerable deficiency, or sudden retrocession of the eruption, in connexion with other bad symptoms; continued delirium or profound coma; a livid or purple colour of the rash, with petechiæ, ecchymoses, or hemorrhage; a livid appearance of the fauces, with gangrenous sloughs or ulcers; extension of the pseudo-membranous exudation into the larynx; the occurrence of severe intercurrent inflammation of the vital organs; gangrene of the extremities, or of the sacrum and hips where pressed upon; and great prostration, as indicated by a very feeble pulse, cold skin, and involuntary discharges.

The absence of the above symptoms, and a gradual subsidence of the disease, are favourable signs; but, as before stated, they cannot be relied on, in consequence of the changes to which the disease is liable; so that a guarded prognosis in scarlet fever is almost always prudent.

Treatment.—In the vast majority of cases, scarlet fever would end favourably without treatment. Hence the reputation acquired by homœopathy in this disease. When the symptoms are very mild, it is advisable to do little more than to keep the bowels open, to administer cooling drinks, to regulate the diet, and to see that the apartment is well ventilated, and of comfortable temperature.

A gentle emetic at the outset of the disease is generally thought, and I believe justly, to have a happy effect in modifying its future course. This remedy should, therefore, be administered in every case, when seen at that stage; for, though it may possibly not be necessary, yet it can do no harm, and it is impossible to foresee what is to be the character of the case. Ipecacuanha may be used, or a mixture of this with tartar emetic.

In all cases, except those of great mildness, it will be proper, in children, to follow the emetic with a purgative dose of calomel, which, if it do not operate thoroughly in six or seven hours, should in its turn be followed by castor oil, magnesia, or one of the saline laxatives. Afterwards, the bowels should be kept open, if necessary, by cathartics, which should be accommodated to the circumstances of the case; those of a depletory character, such as sulphate of magnesia, being given if there is much excitement with considerable energy of system; the Seidlitz powder, when there are nausea and vomiting; magnesia, when there is evident acidity of the primæ viæ; castor oil, when there is abdominal pain; and rhubarb when the system is too feeble to admit of watery purgation. In the incidental diarrhœa, advantage will sometimes accrue from castor oil combined with laudanum; as the bowels are thus cleansed of the offensive secretions which are swallowed, while they are rendered less sensible of the irritant impression. Great care, however, must be taken not to purge to exhaustion.

Is bleeding proper in scarlet fever? Some strenuously advocate the affirmative of this question, and recommend the remedy in almost all violent cases, in the early stage. Some consider it hazardous under any circumstances. In relation to depletion in this disease, it should always be borne in mind that the tendency of the system is usually to an asthenic state; that the cause is probably in general depressing in its nature, though capable of rousing the energies of the system, in many cases, to an active resistance. It should also be remembered that the influence of the cause is, in certain epidemics, much less depressing than in others; so that, while bleeding may be employed with impunity in one, it may be very dangerous in another. The inference from these considerations is, that bleeding should be used with much caution and reserve, and only when there is an obvious indication; as when symptoms of inflammation of one of the vital organs exist, and threaten great danger. For the mere inflammation of the fauces, it is seldom requisite. Indeed, it has in general little influence upon that affection, especially when accompanied with pseudo-membranous exudation. In no instance, even of decided inflammation, should it be resorted to when the pulse is feeble, and other signs indicate a malignant tendency. In all doubtful cases, it is best to have recourse to local depletion by leeches or cups. Should experience show that the disease, in any particular epidemic, is of a more than usually sthenic character, the remedy may be used with less reserve; should malignancy be the predominant character, it should scarcely be used at all. I have seldom found it advisable to bleed in any case; and do not remember the instance, in which it appeared to me that I had occasion to repent my abstinence. "Dr. R. Williams, who has bestowed great attention on this point, has drawn up a table of different epidemics which have prevailed from 1763 to 1834; and adds, that the conclusion which inevitably follows is, that the chances of recovery are diminished by the practice of bleeding, in the ratio of nearly four to one, as compared with the chances, supposing the patient not to have been bled." (*Dr. Burrows, in Tweedie's Syst. of Pract. Med.*) Whenever bleeding is resorted to, it is a good rule to place the patient in a sitting posture; as the failure of the pulse, in this position, will sooner give warning to arrest the flow of blood, than in the horizontal.

In cases of severe serous inflammation accompanying the disease, leeching or cupping may generally be employed with advantage. Leeching is also recommended when there is much external swelling about the jaws; but care must be taken, before it is used, that there is sufficient strength of pulse to bear the loss. Great external swelling sometimes exists, when it is of the utmost importance to husband the resources of the system. In the convulsions of the early stage, it will often be proper to apply leeches to the temples, or behind the ears.

In all cases in which the skin is universally hot and dry, and the patient experiences no sensation of chilliness, the *external application of cold water* is highly useful. It relieves the pungent heat of the surface, quiets restlessness, reduces the frequency of the pulse, and adds greatly to the comfort of the patient. I have generally preferred sponging; some recommend affusion. In doubtful cases, warm water may be substituted for cold.

When the fever is well developed, a course of internal refrigerant treatment should be adopted. The patient should be allowed to drink cold water frequently though moderately, and to hold ice in his mouth if he desire it.* Small doses may be given every hour or two, during the day, of the neutral mixture, solution of acetate of ammonia, citrate of ammonia, or muriate of ammonia, to which, when the stomach is quite retentive, and the general condition of system is not asthenic, minute doses of tartar emetic may be added. When the stomach is irritable, the effervescing draught should be preferred. Nervous symptoms may be counteracted by the addition to the diaphoretics just mentioned of sweet spirit of nitre, Hoffmann's anodyne, or camphor water. Should a sour smell, as often happens, exhale from the patient, he should take bicarbonate of soda or of potassa, three or four times daily. I have found great apparent advantage, in cases attended with a very frequent pulse, from the use of tincture of digitalis, which, to an adult, may be given in doses of from five to ten drops every four hours.

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* Dr. Samuel Jackson, of Philadelphia, formerly of Northumberland, has given to the public highly interesting statements of his success, in the treatment of anginose cases of scarlatina, by means of ice kept constantly in the mouth and swallowed as it dissolved, and of chloride of soda as a local application to the fauces. The ice is to be used in small lumps, or, in the cases of infants not old enough to guard against swallowing the pieces undissolved, inclosed in a gauze bag. When the fever is very high, small quantities of the ice may be swallowed in the form of fine powder. In very young infants, ice-cold water may be injected into the throat, and powdered ice may be swallowed, if there is much fever. To be successful, this practice must be maintained incessantly, night and day, until the inflammation has evidently yielded. The solution of chloride of soda is applied when the disease in the fauces becomes gangrenous. These simple remedies were found exceedingly efficient by Dr. Jackson, and by several other practitioners who had been induced to employ them upon his recommendation. They were not, however, used by him to the exclusion of other measures, such as bleeding, emetics, cathartics, antimonials, cold water to the head, warm water to the feet, &c., when circumstances seemed to call for them; but the ice appears to have been the one most relied on in the anginose cases. (See *Am. Journ. of Med. Sci.*, xii. 261 and 550; and xxii. 45; also *Eberle's Practice of Medicine, edited by Dr. George M'Clellan*, i. 478.)

When the urine is very scanty, and especially if a tendency to delirium or coma should be observed, mild diuretics may be resorted to with hope of benefit, such as sweet spirit of nitre, acetate of potassa, bitartrate of potassa, wine of colchicum root, &c.

But the practitioner should always be on the watch for symptoms of debility, and be prepared to counteract them. In some instances, they attend the case from the commencement, in others come on during its course. They are such as occur in the typhous state of fever. Whenever they are seen, no hesitation should exist in resorting to tonics or stimulants. Sulphate of quinia dissolved in one of the dilute mineral acids, or the compound infusion of Peruvian bark, is admirably adapted to many of these cases. But, when the debility is considerable, it is necessary to use stronger stimulants, such as capsicum, carbonate of ammonia, oil of turpentine, and wine diluted with water, or in the form of wine-whey. The Germans prescribe the flowers of arnica. When nervous symptoms are superadded, musk, assafetida, camphor, or valerian may be employed. Animal broths or jellies should also be given, especially in the advanced stages, and when the blood is depraved. Swelling of the throat, or even comatose or delirious symptoms, should not deter from the use of the above measures, when the signs of debility are evident.

Should the eruption come forth sparingly, or retrocede, and at the same time threatening symptoms appear, efforts should be made to invite it to the surface by the hot bath, and the more active rubefacients. Urtication by means of the nettle has also been recommended.

Solution of chlorine, and chlorate of potassa, have been recommended in the treatment of scarlatina. The aqua chlorinii of the Dublin Pharmacopœia may be given in the dose of a fluidrachm for an adult, and ten drops for a child two years old, three or four times a day. It may be given largely diluted, in one of the aromatic waters, and sweetened. Dr. Watson speaks very favourably of a solution of chlorate of potassa, in the proportion of a drachm to the pint, as a drink; of which from a pint to a pint and a half may be used during the day. I have had no experience with either of the above remedies; but nitromuriatic acid, which contains free chlorine, is sometimes useful in the atonic forms of the complaint.

Local Remedies.—These are important. In slight affection of the throat, it is sufficient to employ demulcent, acidulous, slightly astringent, or saline gargles; such as infusion of flaxseed or slippery elm, water acidulated with sulphuric or muriatic acid or vinegar, compound infusion of red roses, weak solutions of alum, nitre, or common salt, &c. When pseudo-membranous or gangrenous patches are observed in the fauces, and the colour of the mucous membrane is dark red, infusion of capsicum, or the powdered red pepper itself diffused in water or vinegar and water, is an excellent application. (See *U. S. Dispensatory.*) It certainly exercises a peculiar and very happy influence over this low species of inflammation. Very often the patient finds it soothing to the throat, even though burning to the mouth, in which the same condition of the membrane does not exist. The remedy is, I think, too much undervalued by recent writers. In children who cannot gargle, I apply it by means of a large camel's-hair pencil, or some equivalent instrument, loaded with the powder mixed up with water, and turned about in the fauces. I have also used with advantage a strong solution of sulphate of zinc, containing fifteen or twenty grains in a fluidounce of water, as an application to the patches; and the nitrate of silver is also an excellent remedy, especially when the patches threaten to invade the larynx. Applied in solution, varying in strength from a scruple to a drachm to the fluidounce of water, and repeated daily or twice a day, the latter preparation is now much employed, and by some practitioners is thought very favourably to modify the course of the disease when early resorted to. Dr. Eberle speaks favourably of a strong infusion of the root of the common wild indigo (Baptisia tinctoria) in putrid sore-throat. The offensive odour which proceeds from the throat, in some of these cases, may be corrected by gargles or washes of solutions of creasote, chloride of soda, and chloride of lime, or by diluted pyroligneous acid, which act also favourably upon the diseased surface.

Leeches may sometimes, as already stated, be used externally when there is considerable strength of pulse; and some also recommended blisters. I have employed these frequently, but not with much apparent advantage. In the asthenic cases the blistered surface is liable to slough. Rubefacient applications to the throat, such as the liniment of ammonia, tincture of capsicum, or oil of turpentine diluted with olive oil, may be used. Among the best external applications is a large emollient poultice.

During convalescence, it is important to guard against exposure to cold air, to keep the bowels regularly open, and, if the patient remain feeble with a want of appetite, to invigorate the stomach and system by the mineral acids, quinia, or the simple bitters.

The rules of diet applicable to other kinds of fever should be observed in this; and it is unnecessary to repeat them.

The *sequelæ* of the disease often require attention. When the external parts about the neck suppurate, emollient poultices should be applied, and the patient's strength supported by tonics and nutritious food. Red oxide of mercury mixed with almond oil has been recommended in the otirrhœa which is apt to follow the disease.

The diarrhœa and inflammatory affections which set in must be treated as if these affections were original, reference being had to the debilitated state of the system. But it is proper to observe that, when they occur after a mild attack of the disease, depletion is often very well borne; the depressing influence of the poison having been removed. The brain must be especially watched, and, if symptoms of stupor supervene, blood should generally be taken from the arm. For the treatment of dropsy consequent upon scarlet fever, the reader is referred to the subject of dropsy.

Other modes of treating scarlatina have been employed, with great asserted success. Dr. John Gardner has treated thirty cases, some of which were of alarming violence, by means of belladonna, without the loss of a patient. He gives from half a grain to a grain of the extract, every three, four, or six hours, according to its effects, with no other medicine except an occasional dose of castor oil. (*Braithwaite's Retrospect*, xxiii. 28.) Inunction of the surface is highly recommended by Dr. Schneeman, of Hanover, and the practice has been successfully repeated by others. The whole surface of the body, with the exception of the face and scalp, is rubbed with a piece of fat bacon every morning and evening. (See *Am. Journ. of Med. Sci.*, N. S., xx. 503.) Among the new modes of treatment is also the external application of hot water, recommended by Dr. Bully, of the Berkshire Hospital. For the mode of employing it, the reader is referred to *Braithwaite's Retrospect* (xx. 30), and to the *Medical Times* (August 29, 1849). In malignant cases, brewers' yeast has proved highly useful in the hands of Dr. G. B. Smith, of Baltimore. He gives the yeast mixed with an equal bulk of water, and sweetened with brown sugar, in the dose of a tablespoonful every two hours. (*Boston Med. & Surg. Journ.*, xlvi. 9.) Dr. H. L. Byrd, of Savannah, Geo., has recently met with great success from the use of the tincture of chloride of iron, given in a moderate dose every four hours or less frequently. (*Charleston Med. Journ. & Rev.*, ix. 165.)

Preventive Treatment.—It is peculiarly important to guard children against scarlatina; as the older they grow, the less liable they are to be attacked. Hence, they should be kept separate as far as possible from every source of infection; and free ventilation of the sick chamber should be employed, in order to dilute and dissipate the poison. Different prophylactic medicines have been recommended; among which belladonna enjoys perhaps the confidence of the greatest number of practitioners. Its use for this purpose was introduced by Hahnemann, on the ground that it produces effects analogous to those of scarlatina. I confess, though I have used belladonna much, I have never seen from it anything resembling scarlatina. But whatever may have been the origin of the practice, its value must be determined by experience. The weight of testimony is, I think, decidedly against its possession of any prophylactic virtues. It is used in very small doses. Three grains of the extract are dissolved in a fluidounce of distilled water, and three drops of the solution given, twice a day, to a child under one year, to be increased one drop for every additional year. Another prophylactic is said to have been employed with great effect by several physicians of Groningen. It consists, for children from two to four years old, of a sixteenth or eighth of a grain of calomel, and the same quantity of the golden sulphur of antimony, with a little sugar or magnesia, given from once to four times daily. (*Dict. de Méd.*) Dr. John Webster, of London, strongly recommends, as a means, conjointly with isolation, of preventing the spread of scarlatina, the frequent sponging of the patient with warm vinegar. He believes, as the result of much observation, that with this precaution the disease will very seldom be communicated. (*Ed. Month. Journ. of Med. Sci.*, Dec. 1849, p. 1295.) I have had no experience with either of the above prophylactics.

Article XII.

ERYSIPELAS.

Syn.—Saint Anthony's Fire.—Rose.—Ignis Sacer.

The term erysipelas was derived from the ancients, to whom the disease was known. It is a constitutional affection, characterized by a peculiar, spreading, circumscribed inflammation of the skin, with fever beginning a little before, simultaneously with, or a little after the local disease.

SYMPTOMS, COURSE, &c.—Languor, general uneasiness, aching or soreness in the limbs and joints, chilliness, or rigors alternating with flushes of heat, are succeeded by a frequent pulse, hot skin, a furred tongue, anorexia, thirst, sometimes nausea and vomiting, headache, restlessness, muscular weakness, and not unfrequently soreness of throat, or swelling of the lymphatic glands, in the vicinity of the part which is to be the seat of the cutaneous inflammation, as of the neck in erysipelas of the face, and of the axilla or groin in that of the extremities.

On the second or third day of the fever, though sometimes earlier and sometimes later, and occasionally as the first observable phenomenon, there may be seen, upon some part of the surface, a small reddish spot, usually somewhat elevated, painful, and tender to the touch. This may occur upon any portion of the body, but is much more frequent upon the face than elsewhere, especially upon the side of the nose, the cheek, or the rim of the ear. The inflamed spot gradually spreads, usually in all directions, though often more rapidly in one than in another, exhibiting almost always, as it advances, an irregular, abrupt, and somewhat elevated margin, which forms a striking boundary between the sound and the diseased skin. In some instances, the border is less definite, though scarcely ever gradually shaded off, like ordinary inflammation, so that it cannot be traced. The diseased surface is red, often shining, hot to the hand, and generally harder than the sound skin. The redness disappears under the pressure of the finger, but quickly returns when the pressure is removed. The distance to which the inflammation extends differs greatly. In some instances, it advances slowly and is confined within narrow limits; in others, it spreads quickly over large portions of the surface; and, in certain comparatively rare cases, does not cease to make progress until it has invaded successively every part of the skin. Almost always its progress is continuous; but now and then instances occur, in which it attacks, in succession, separate and even distant parts of the body.

In the face, it sometimes confines itself within the limits of the features, but generally has a tendency to spread upward to the scalp, and not unfrequently extends over the whole head, and even downward to the neck, though rarely so far as the chest.

There is usually considerable swelling, the skin being thickened and hardened, and the subcutaneous cellular tissue in general more or less distended, especially in parts of loose texture, as in the eyelids and about the eyes, in the scrotum and prepuce, and in the vulva, which parts are apt to become strikingly edematous.

The face is often so much swollen that every characteristic feature is obliterated. The eyes are closed, the lips, nose, cheeks, and ears greatly enlarged, the nostrils so much obstructed that the patient cannot breathe through them, the mouth so stiff that he speaks with difficulty, and the external meatus sometimes so much narrowed as to interfere with hearing. When the disease extends over the scalp, this is usually much swollen and puffy, and the whole head sometimes enormously enlarged.

A burning, tensive, pricking, and smarting pain is usually experienced; and the parts are so tender that pressure produces much uneasiness. When the whole scalp is affected, it is difficult for the patient to find a comfortable position for the head. The pain, however, often remits.

Sometimes the inflammation gradually rises for three or four days, then gradually subsides, without apparent effusion of any kind, and terminates in desquamation. But more frequently, about the third or fourth day, the cuticle is elevated by a serous liquid, which appears sometimes in the form of minute eczematous or miliary vesicles, sometimes in that of blisters or blebs like the bullæ of pemphigus, from a quarter of an inch to an inch or more in diameter, which occasionally run together, so as to produce an extensive blistered surface. The surface is often moistened by exudation from these vesicles, or their rupture. On the fifth or sixth day they begin to dry, and on the seventh or eighth form small crusts or scales, which usually separate by the tenth, leaving the skin covered with a new cuticle. When the hands or feet have been affected, the cuticle sometimes separates entire, so as to form a mould of these parts. The redness and swelling subside at the same time, and are nearly or quite gone when the crusts are fully formed. The whole duration of the inflammation is thus, in favourable cases, about a week, though sometimes shorter, especially in the young and healthy, and sometimes, from various causes, considerably protracted. Even after desquamation, it is sometimes long before the skin acquires its natural appearance and flexibility. Dr. J. W. Begbie has found the urine often moderately albuminous in the early convalescence of severe cases of the disease. (*Ed. Month. Journ. of Med. Sci.*, Oct. 1852, p. 829.)

The course of erysipelas often varies more or less from that above described. Thus, while the part first affected is going through the regular changes, the inflammation may have advanced to another part, which goes through its own periods of increment and decline; and so on with different parts successively; so that the case may be prolonged for a month or more.

After the removal of the cuticle from the vesicated parts, the surface sometimes continues to exude an acrid lymph for several days, and may even pass into a state of suppuration or ulceration, which greatly retards the cure.

In some cases, the inflammation in the subcutaneous tissue ends in suppuration, and even in gangrene of the cellular tissue. In the former case, pus of a healthy appearance escapes through ulcerated openings in the skin; in the latter, grayish strings of the dead membrane, like wet tow, come away, along with a thin, ichorous, and fetid purulent discharge. The face sometimes presents the disease at once in its different forms; portions undergoing resolution without vesication, others exhibiting vesicles on the surface, and others, as the parts about the eye, discharging pus and disorganized cellular tissue. The tissue beneath the scalp not unfrequently, in bad cases, passes into this gangrenous state, though the skin itself generally remains sound, except when ulcerated to permit the escape of the dead matter. But this condition of the disease is still more frequent upon the limbs and trunk. In these parts, the pus not being duly confined, as in phlegmonous inflammation, by the exudation of coagulable lymph, often travels great distances, destroying the subcutaneous cellular and adipose tissues, dissecting the muscles, and involving life in great danger. I have seen a case in which the skin over almost the whole front of the abdomen was thus separated from the muscles beneath. Even where recovery takes place in such cases, deformity may ensue from the resulting contraction, and difficulty of movement from the adhesions which may form among the muscles, or between them and the skin. Sometimes gangrene of the skin itself is added to the various mischief. This happens more especially in the extremities. It is obvious that, in all these cases, when not fatal, recovery must be considerably postponed.

During the continuance of the cutaneous inflammation, the fever also continues, and sometimes in a greatly aggravated form. In vigorous constitutions, with no asthenic tendency in the disease, the pulse remains full and tense, without being very frequent; and, unless the inflammation invades the scalp, though there may be a little occasional delirium, the fever has generally an open inflammatory character, and offers little to cause alarm. But, when the scalp is involved, symptoms of cerebral disorder are very often evinced, such as headache, tinnitus aurium, restlessness, and decided delirium, or, what is perhaps more frequent, and constitutes one of the most striking features of these cases, a tendency to drowsiness, stupor, and even coma. The inflammation is supposed to penetrate through the cranium to the cerebral meninges; though fatal cases of this kind have occurred, in which no disease was discovered in the encephalon after death.

I have known of one or more instances, in which inflammation appeared to reach the brain through the nostrils and ethmoidal cells, with fatal effect. Sometimes it passes from the skin into the mouth, travels into the respiratory and alimentary passages, and produces characteristic effects in these several situations. The lips are dry, tense, and shining; the interior of the mouth, including the tongue, is red and dry; the fauces are reddened, and the tonsils sometimes swollen; deglutition is painful; and gastritis with nausea and vomiting, and enteritis with diarrhœa have been supposed to arise from the same cause. Certain cases of death from erysipelas have been ascribed to pseudomembranous exudation in the glottis, and others to effusion into the submucous tissue in the same part, so as to close the passage against the admission of air.

Not unfrequently the fever attendant on erysipelas is asthenic, either from the feeble constitution of the patient, the depraved state of his health at the time of attack, or the peculiarly depressing nature or malignancy of the cause producing the disease. Sometimes the asthenic or typhous symptoms are present from the beginning; but, in other instances, do not make their appearance till some time in the course of the complaint. It is scarcely necessary to repeat the symptoms, which are those of the typhous state in fevers generally. The most prominent are a feeble and often very frequent pulse, a cool or irregularly heated surface, restlessness, subsultus, low delirium or stupor, a brown or black and dryish tongue, dark sordes about the lips and teeth, a purplish or livid colour of the inflamed surface, bloody serum in the vesicles, ecchymoses, and a strong tendency to gangrene. Internal inflammatory or congestive complications are not uncommon, but all of the same low and asthenic character. Diarrhœa, with black fetid stools, not unfrequently comes on before the close; and, if the patient do not sink under the immediate disease, he is apt to be worn out by the suppurative and ulcerative processes, consequent upon the local mischief.

Another evil incident to erysipelas is the occasional metastasis of the external inflammation to some interior and vital organ. This is, perhaps, less frequent than might be supposed from the accounts of authors; but it may be every now and then observed. The greatest danger is probably of metastasis to the brain and heart, or their appendages. It is marked by a sudden disappearance of the external inflammation, and the simultaneous occurrence of symptoms of internal disturbance. Sometimes the external affection suddenly disappears, without any internal disorder. Under such circumstances, the incident, so far from being alarming, is satisfactory. The retrocession of the eruption is probably sometimes the result of the previous occurrence of the internal inflammation. But it is at least sometimes also the antecedent, and probable cause; as when repelled by cold, or certain local applications. I have known a case in which a solution of corrosive sublimate, applied to an erysipelatous inflammation upon the anterior of the chest in an old man, caused a speedy and entire disappearance of the cutaneous redness, followed by an enormous tumefaction of the subcutaneous tissue, which was swollen so as to resemble the mammæ in women, and was of a stony hardness. The patient died. Sometimes the retrocession is probably owing to the sudden occurrence of great prostration. Such a case happened to me in the Pennsylvania Hospital. The erysipelas, which was facial, suddenly disappeared, and the patient became delirious, with an exceedingly feeble pulse, cold skin, and other evidences of profound debility. He was stimulated actively with milk punch, &c.; the vital actions were restored, and with them the erysipelas, which afterwards terminated happily.

But, notwithstanding these occasional protracted or dangerous cases, erysipelas, in the vast majority of instances, does well; the fever subsiding along with the inflammation, and recovery taking place in a period varying from five to twelve days. Death in private practice, under appropriate treatment, and in the absence of any malignant epidemic influence, is very rare, unless in persons of feeble health, or intemperate habits.

Numerous varieties of erysipelas are referred to in practical works; and though most of them are merely modifications, such as above described, it will be proper to notice some of them more distinctly.

Erysipelas phlegmonodes is a name conferred upon that form of the disease in which the inflammation extends deeply into the subcutaneous tissues. It is attended with greater pain and swelling than the more superficial variety, and usually with severer general symptoms. Suppuration and gangrene of the cellular membrane are not uncommon; and, when the disease, as sometimes happens, penetrates beneath the fasciæ, the sufferings of the patient are greatly aggravated by the compression of the inflamed parts, and much organic mischief may result from the confinement of the pus and sanious products of gangrene that are apt to form. This variety sometimes ends in the gangrenous.

Erysipelas erraticum.—E. ambulans.—Wandering erysipelas is that superficial form in which the inflammation, confined chiefly to the skin, and perhaps more especially to its superficial portion, spreads rapidly over the surface; not stopping, in some instances, until it has extended over the whole body. It seldom, however, covers the whole surface at once; but almost always fades and undergoes resolution in one part, while advancing in another. Sometimes, instead of travelling continuously over the body, it attacks successively distant and separate parts, as the face, for example, at one time, and one of the limbs at another. By some, the term *E. erraticum* is confined to the former, and *E. ambulans* to the latter of these forms. They are both peculiarly liable to metastasis, and this probably constitutes their chief danger. Though somewhat tedious, they generally end in recovery unless in cases of retrocession, or when occurring in the advanced stage of other debilitating diseases.

Erysipelas œdematodes.—When erysipelas occurs in a cachectic state of system, with a tendency to serous effusion, it is apt to assume the edematous form; and the same condition is presented when the disease attacks parts already edematous, as, for instance, the legs of dropsical patients, which often become the seat of this kind of inflammation, in the advanced stages of the disease, and especially if punctured. The parts most commonly affected with edematous erysipelas are the lower extremities, the genitals, and more rarely the face. The colour of the surface is not so deeply red as in the other varieties; the skin appears stretched and shining, but not elastic; and the surface pits on pressure. This form of the disease, though it not unfrequently ends in resolution, is often attended by suppuration and sloughing of the cellular tissue, and sometimes by the death of portions of the skin.

Erysipelas gangrænosum.—The gangrenous tendency may either be original, dependent upon the depressing nature or malignancy of the cause, upon the depraved condition of the system, especially of the blood, or upon certain co-operating influences of a debilitating character, as confined and impure air, unwholesome or scanty food, &c.; or it may result from the excessive violence of the inflammation. In the former case, it may be obvious from the commencement of the disease; in the latter, it is not seen until an advanced period. The tendency is indicated by a peculiarly hot and burning pain, and a purple or livid hue of the redness. The near approach of the gangrene is shown by the slowness with which the blood returns after removal by pressure, or by its imperfect removal, a doughy feel of the parts, and the formation of small blisters filled with a turbid or reddish serum. The appearance of grayish or blackish spots beneath the separated epidermis, a total suspension of the circulation in any part of the surface, a reduction of the pain, and a diminution of the temperature, indicate its positive existence. It is apt to occur when erysipelas attacks patients with typhoid fever, or infants soon after birth; and is not uncommon in hospitals, and during the prevalence of malignant erysipelatous epidemics. It is always indicative of great danger. The constitutional symptoms are of a typhoid character.

The above varieties have reference to the character of the local affection. There are others having a different basis. Thus, the inflammation sometimes occurs without fever, generally as a consequence of wounds or other pre-existing local disorder. It may then be styled *local erysipelas*, or simply *erysipelatous inflammation*. Sometimes there is reason to believe that the fever occurs without the affection of the skin, as in other exanthematous diseases. This is shown particularly during the epidemic prevalence of the complaint, when fevers are often observed, in which the cutaneous inflammation appears to be superseded by that of one of the interior organs or surfaces. Under such circumstances, the disease may be denominated *erysipelatous fever*. Occasionally cases are observed, in which the tongue, conjunctiva, and skin have a yellowish hue, the urine is dark yellow, and the alimentary canal exhibits evidences of bilious disorder. In this form the disease is called *bilious erysipelas*. Its peculiarities depend either upon a torpid state of the liver, or on an excessive production of bilious matter in the blood. The name of *malignant erysipelas* is given to those terrible forms of the disease, generally the result of epidemic causes, which exhibit the highest grade of the typhous condition, a strong disposition to gangrene, and all those phenomena which depend upon a disorganized condition of the blood. Some of their characteristic phenomena will be described in a brief account, which I propose to give directly, of the epidemic erysipelas which raged in different parts of the United States, in the years 1842 and 1843, and subsequently, under the popular name of *black tongue*. Still another form, which has been recognized by some as a distinct variety with the title of *erysipelas neonatorum*, occurs in infants soon after birth. Sometimes, indeed, the child is said to be born with the disease upon it. The inflammation generally begins upon some part of the abdomen, and spreads rapidly over the trunk, to the genitals, the nates, and lower extremities. It may also begin upon the face or limbs. It is much disposed to suppuration and gangrene, and is exceedingly fatal. The disease is said to be frequently associated with peritoneal inflammation. It appears to be more common in Europe than this country, and probably affects more especially children born in crowded hospitals, than under ordinary circumstances.

ANATOMICAL CHARACTERS.—The blood drawn during life has the buffy coat. After death, the redness of the skin often disappears, but a brownish tinge is apt to be left behind; the epidermis easily separates; and the true skin, and subcutaneous cellular tissue exhibit marks of inflammation. The small veins have been observed to be frequently red on their inner surface, and to be filled with pus; but, according to Rayer, this is by no means uniformly the case. Pus is often found in small abscesses, or diffused extensively in the cellular tissue and among the muscles. Sometimes small collections are found in the substance of the large organs, as the lungs and liver. When death ensues from coma, serous effusion is sometimes observed under the arachnoid and in the ventricles; and the veins of the pia mater are distended; but sometimes, also, no morbid appearances are observed in the encephalon. Of course, the incidental inflammations which not unfrequently supervene in erysipelas leave their ordinary effects behind them.

CAUSES.—These are not altogether well understood. The disease has been ascribed to cold; stimulant articles of food and drink; excessive fatigue; violent mental emotion, as of fear or anger; suppression of habitual discharges, as of the menstrual or hemorrhoidal flux, or from old ulcers; and even the transfer of rheumatic or gouty irritation. It may also originate in consequence of any undue excitement or irritation of the skin, as from the direct heat of the sun, burns, rubefacients, blisters, issues or setons, ulcers, wounds of all sorts, whether from surgical operations or accidental contusions, and even such slight injuries as the sting or bite of an insect, the wound of the lancet, or the scratch of a pin. In these cases the inflammation spreads from the point previously diseased.

But none of these causes are capable, of themselves, of giving rise to erysipelas. In the vast majority of instances, they produce no such result, and even in persons in whom they cause the disease at one time, they very often fail to do so at others. There must, therefore, be something else; something which predisposes the individual to this particular form of disease rather than to others. Such a predisposition appears to be possessed by some persons constitutionally. These have frequent attacks of erysipelas from some of the causes above mentioned, and sometimes without any apparent cause; the predisposition alone being sufficiently powerful to bring about the result. The attacks are sometimes periodical; certain persons having the disease once, twice, or oftener during the year; others, and especially women, every month. Not unfrequently, the predisposition is the consequence of disease. Dropsy predisposes to erysipelas, and the same is the case to a certain extent, with everything that depraves the system. The intemperate are more liable to the disease than the temperate. Influences which tend to depress or debilitate the system, even without producing open disease, have the same effect. Hence, partly, the prevalence of erysipelas in hospitals. But there is also some unknown condition of the atmosphere, which greatly favours the production of the disease; so that, when it exists, the slightest causes will give rise to this form of inflammation, though, on other occasions, they may have no such effect. It is felt especially in large infirmaries; but is nevertheless independent of the ordinary circumstances of those institutions; for no observable difference can be recognized between these circumstances, during the existence of this influence, and at other times. It is occasionally so strong that the slightest irritation of the surface induces an attack of erysipelas; and, when it prevails, it is hazardous to bleed, leech, or apply a blister, not to mention serious surgical operations, which are altogether unjustifiable. Wounds about the head are peculiarly liable to this unpleasant complication. It has been noticed that the predisposition to erysipelas exists in the ordinary wards of hospitals, at the same time that puerperal fever prevails in the lying-in wards.

Some have ascribed the occurrence of erysipelas, under these circumstances, to contagion; and cases have been adduced, which seem strongly to sustain the opinion of the communicability of the disease. It is, indeed, a not uncommon opinion, especially in Europe, that puerperal fever and erysipelas, occurring epidemically, are interchangeable diseases, the one being able to produce the other by personal communication.* But neither in public nor private practice, have I ever seen a case of erysipelas in which there appeared to be any proof of a contagious origin; nor do I believe that, as it ordinarily occurs, it is in the least degree contagious. When, however, typhus fever and erysipelas prevail together, there is no difficulty in accounting for apparent instances of this kind. An individual may receive the typhus by contagion, and erysipelas may develope itself at the same time under the prevailing influence; the febrile movement acting as the exciting cause of the latter complaint.

No alternative remains but to ascribe the prevalent tendency to erysipelas, above-mentioned, to epidemic influence. This sometimes acts upon a much more extensive scale, not only affecting limited localities, but wide regions of country. Destructive epidemics of erysipelas have occurred from time to time in Europe; and several parts of our own country have been ravaged by a similar epidemic, during the last few years.

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* See for cases apparently confirmatory of this view, the *American Journal of Medical Sciences* (N. S., xx. 250), quoting from the *Edinburgh Monthly Journal of Medical Sciences* for March, 1850; also the *London Medical Gazette* for October, 1851, p. 722.

Epidemic Erysipelas of 1842, 1843, *&c.—Black Tongue.*—The newspapers, a few years since, teemed with accounts of a destructive pestilence, appearing in remote and unconnected portions of the country, which, from one of its prominent symptoms, came to be known by the popular name of *black tongue.* Several accounts of the disease have been published in the medical journals, to which I am indebted for the facts contained in the following summary, as I have very seldom had the opportunity of witnessing the disease.* It prevailed in several of the New England States, in those of the West and Northwest, in the interior of Pennsylvania, and in several of the Southwestern States, during the years 1842, 1843, and 1844; and I have heard accounts of it in isolated neighbourhoods in some of the Southern Atlantic States. The disease was of different grades of violence in different places, being sometimes so mild that almost every case recovered, in others so deadly that more than half of those attacked perished. It did not uniformly put on the appearance of erysipelas. In some places, most of the cases were of this character, in others not more than one in six, or even a smaller proportion; the affection of the skin being replaced by some internal inflammation, generally of the mucous or serous tissues, though sometimes also of the parenchyma of the organs, especially of the lungs. But the external inflammation was the most common and characteristic symptom. It is a very interesting fact, recorded both by Dr. Sutton and by Drs. Hall and Dexter, that puerperal fever was very prevalent at the same time, and in the same districts as the erysipelas; and some cases are stated, in which it appeared as though the former disease had been produced by contagion conveyed from the latter; while, conversely, a slight prick of the finger of a physician, received in the post-mortem examination of a female who had died of puerperal fever, became the starting-point of an extensive and severe erysipelatous inflammation.

The disease very often began with difficulty of swallowing from inflammation of the fauces; and, if otherwise, angina was very apt to ensue. The first general symptoms were feelings of lassitude, pains in the back, loins, extremities, head, &c., nausea and retching, a frequent and depressed pulse, a fetid breath, cold and contracted skin, shrunken features, anxiety of countenance, and rigors more or less severe and protracted. The pains were often exceedingly acute, like those of neuralgia, shooting through various parts of the body, and sometimes darting from a finger or toe, the heel, &c.; and it was observed that the limb thus affected was apt to become the seat of the subsequent inflammation. After a variable continuance of some or all of the above symptoms, occasionally extending to twenty-four hours or longer, febrile reaction came on, with a hot skin, frequent pulse, great restlessness and anxiety, delirium, furred tongue, &c. In the erysipelatous cases, the cutaneous inflammation appeared generally on the third or fourth day, though sometimes not earlier than the seventh. It was no uncommon event for the eruption to disappear suddenly; and this was generally an unfavourable sign. The inflammation had a strong tendency to gangrene, was not unfrequently attended with phlyctenoid or carbunculous tumours, and often ended in great destruction of the cellular tissue, muscles, lymphatic glands, &c., which were discharged in a mortified state, with a thin, exceedingly acrid, and offensive liquid. "So corroding and acrid was the fluid, that the hardest steel was directly penetrated by it as by nitric acid." (*Hall* and *Dexter*.) The fever, though at first inflammatory, with considerable strength of pulse, quickly lapsed into the typhous state; and the loss of a small quantity of blood was often sufficient to induce syncope. The tongue, at first covered with a gray or yellowish coat, became brown or blackish as the disease advanced. Hemorrhage was not uncommon in the latter stages. In some cases, the nervous symptoms were predominant, and occasionally the disease commenced with coma, from which the patient was never roused. When the erysipelatous affection did not appear, and sometimes along with it, there was violent internal inflammation. The mucous membrane of the fauces, mouth, nostrils, &c., was especially apt to suffer; and sometimes the swelling and pain in the throat, tongue, &c., were so great that deglutition was impossible. Occasionally the inflammation extended downwards into the air-passages of the lungs, the stomach, and even the bowels, or upwards into the nasal passages and the brain. Peritonitis and pleuritis were not uncommon, and were extremely fatal. In some places, pneumonia was also a frequent complication. The duration of the complaint was very uncertain. Sometimes death occurred in two or three days, but more frequently about the eighth or tenth day, and occasionally much later. Convalescence frequently took place in about a week or ten days, as in ordinary erysipelas, but often also it was greatly protracted.

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* The papers alluded to are those of Dr. George Sutton, of Aurora, Indiana, in the *Western Lancet* for November, 1843; of Dr. Charles Hall, of Burlington, Vermont, and Dr. George J. Dexter, of Lancaster, New Hampshire, published in the *Am. Med. and Surg. Journ.* for January, 1844; of Dr. D. Mecker, in the *Illinois Medical and Surgical Journal* for June, 1844; and of Dr. Jesse Young, of Chester, Pennsylvania, in the *Med. Examiner* for September, 1844. See also an article by Dr. Montgomery in the *St. Louis Med. and Surg. Journ.*, vii. 490, and another by Dr. H. N. Bennett, of Bridgeport, Connecticut, in the *N. Y. Journ. of Med.*, N. S., xi. 9.

Erysipelas from Wounds in Dissection, &c.—Another cause of erysipelas, which merits notice, is the exposure of a wound or abrasion of the hand to the liquids of the dead body in dissections, or even sometimes to the secretions of the living body, as occasionally happens to the accoucheur. An inflammation generally runs up the absorbents of the arm, and not unfrequently spreads out into an erysipelatous affection not only of the arm, but also of the chest and neck, with the formation occasionally of immense abscesses, and great destruction of the cellular tissue. I have no doubt that the peculiar effect, in these cases, is owing to the nature of the poison. It is not merely the production of erysipelatous inflammation by a wound in persons predisposed to it; for in the different arts, where wounds of the hands are much more common, and exposure to irritant causes certainly not less so, how seldom do we witness similar effects! The fever which accompanies this form of the disease, is apt to have a low, asthenic tendency.

Erysipelas occurs at all seasons, but most frequently, as is asserted, in the spring and autumn. All ages are liable to it. Women are said to be more frequently affected than men. One attack offers no security against a second.

NATURE.—The inflammation in erysipelas is of a peculiar nature, and derives that peculiarity from some not understood state of system, or from some equally unknown peculiarity of the cause. That it differs from ordinary inflammation is proved by its disposition to spread, the distinct boundary it preserves in spreading, the severe burning which attends it, its tendency to gangrene, and the indisposition it evinces to the secretion of coagulable lymph, which is so characteristic a product of phlegmonous inflammation. In the disease now under consideration, it is obvious that the fever, though it may be aggravated by the local affection, is wholly independent of it in its origin; for it often precedes the inflammation by one, two, or three days. It is highly probable that, in cases of traumatic erysipelas, there may be the same constitutional state, but in a degree insufficient to excite fever without the aid of the local disease.

DIAGNOSIS.—It may be difficult or impossible to distinguish the initial fever of erysipelas, before the appearance of the cutaneous affection, from many other febrile diseases; but Frank has pointed out a symptom which he considers diagnostic; and Chomel and Blache in relation to it make the following observation:—" Whenever a patient has exhibited, for twenty-four or forty-eight hours, an intense febrile movement, attended with *pain, swelling, and tenderness of the lymphatic glands of the neck*, we have not hesitated to announce the approaching developement of erysipelas, and in no case has the diagnosis been invalidated by the result." (*Dict. de Méd.*, xii. 233.)

After the occurrence of the inflammation, the only disease in relation to which there can be any difficulty is erythema, and from this erysipelas may be distinguished by the greater swelling and hardness, the well-defined boundary, and the continuity of the diseased surface.

PROGNOSIS.—The grounds of prognosis in this disease have been, for the most part, already given in the description of its varieties. As it commonly appears in good constitutions, it very generally ends favourably. In erysipelas of the face, the chief danger arises from the brain becoming involved, and this is most likely to happen when the inflammation invades the scalp, though this last event often occurs without serious consequences. A sudden disappearance of the external disease, with the occurrence of symptoms indicating internal irritation or inflammation, is unfavourable. Such a metastasis is most likely to happen in the wandering variety. The phlegmonous form is, in other respects, more dangerous than the superficial. The gangrenous variety is very dangerous. The very old, the intemperate, and those already nearly worn out by previous disease, are apt to die. This is peculiarly the case in dropsy, in which a fatal erysipelas often attacks the swollen limbs, especially after punctures; but death, in these instances, is only a little hastened. The disease is often fatal when it occurs near the close of febrile diseases; though recoveries also, under such circumstances, often take place. The prognosis is always more unfavourable in hospital than in private practice. In new-born children, the disease is exceedingly fatal; as it often also is when it occurs epidemically, and whenever it puts on a malignant form. Coma and continued delirium are always unfavourable symptoms.

Sometimes erysipelas is productive of good. It has often permanently cured impetigo, psoriasis, and other obstinate cutaneous affections; and temporarily removed syphilitic disease upon the surface of the body. It is asserted even to have cured elephantiasis.

TREATMENT.—I shall treat first of the general, and afterwards of the local measures. Mild cases require little interference. Rest, saline laxatives, refrigerant drinks, and a low diet, constitute the routine of treatment. The physician, however, should always be on the watch, prepared to counteract any threatening change that may occur.

In severe cases, an emetic has been recommended at the commencement. This remedy is supposed to be peculiarly useful in the bilious form. It no doubt does good, when the stomach is loaded with bile or other irritating matters, and may also be beneficial, when the liver is torpid, by rousing it into activity. It may even have the effect, attributed to it in some of the other exanthemata, of favourably modifying the future course of the disease. But I have myself found no such advantage from emetics, in ordinary cases, as to compensate for their inconvenience to the patient, and now seldom employ them.

A brisk cathartic at the beginning is almost always proper. Its energy should be graduated somewhat to the apparent violence of the case. Often a full dose of Epsom salt will be sufficient. When there is considerable fever, recourse may be had to senna and salts, or to calomel either alone or combined with other cathartics, as compound extract of colocynth, jalap, or rhubarb. The compound cathartic pill is an eligible preparation. When calomel is used alone, it should be followed by castor oil, or sulphate of magnesia. The mercurial is especially indicated whenever there is torpidity of the liver, or too much bilious matter in the circulation; consequently in most of the cases called bilious. After the bowels have been thoroughly evacuated, it will generally be sufficient to procure one or two passages daily, which should be done by means of saline cathartics during active febrile excitement, and rhubarb in the low or typhous states of the disease. Magnesia will sometimes be found useful to counteract acidity, and castor oil in states of intestinal irritation.

Should the pulse be strong and full, and the inflammation severe and threatening, bleeding may be employed advantageously in the early stages, and in the young and vigorous with considerable freedom. It may sometimes even be repeated; but this is seldom necessary. Bleeding is not so well borne as in ordinary inflammation; and it often happens that the loss of a small quantity of blood produces a very decided impression on the pulse and general strength. The habits of the patient, or his previous state of health, have often been such as strongly to contraindicate the remedy; and, under these circumstances, it should not be resorted to unless imperiously called for. In many cases, it is quite unnecessary, and, in not a few, is positively forbidden by the existing debility. It should be recollected that bleeding will not cure the erysipelatous inflammation, unless by inducing such a degree of depression as almost to prevent the blood from circulating in the capillaries; and this is always dangerous. The remedy, therefore, should not be employed for this purpose. It is indicated when danger of suppuration or gangrene may exist from the violence of the local disease, or some internal and vital organ may be threatened or attacked. It should always be employed when stupor, or other evidence of congestion or inflammation of the brain is presented, unless, as unfortunately often happens, the pulse may be too feeble to permit it. In doubtful cases, the patient should sit erect during the bleeding, and the flow be stopped immediately upon the flagging of the pulse, or the slightest intimation of the approach of syncope.

Cooling diaphoretics, such as the neutral mixture, effervescing draught, solution of acetate or citrate of ammonia, muriate of ammonia, nitrate of potassa, and, when the stomach is not irritable, the antimonials, may be used during the active state of the fever. I am usually satisfied with the neutral mixture or effervescing draught, preferring the latter when the stomach is irritable, and adding, when this organ is quite retentive, and the fever decidedly sthenic, small quantities of tartar emetic.

When the general action is feeble, whether at the commencement, or becoming so in the course of the disease, and especially when nervous symptoms are exhibited, such as restlessness, wakefulness, and slight delirium, the combination of opium and ipecacuanha is an admirable remedy, which may be aided by the spirit of nitric ether, the compound spirit of sulphuric ether, camphor water, and the warm bath, if deemed advisable. The opiate, however, should not be used in the somnolent or comatose cases.

If, after sufficient depletion, the local symptoms are threatening, but without any complication of gangrene or malignancy, calomel or the blue mass should be added to the opium and ipecacuanha, and so used as to produce the slightest possible mercurial impression. Sometimes, when opium is contraindicated, the calomel and ipecacuanha may be used without it. For the doses in which these remedies should be employed, the reader is referred to former articles on febrile diseases.

When the symptoms assume a typhous form, with a failing pulse, and perhaps a gangrenous tendency in the local affection, it becomes necessary to support the system by stimulants and nutritious food. Opium, sulphate of quinia, the mineral acids, carbonate of ammonia, wine-whey, animal broths and jellies, and, in extreme cases, milk-punch, egg and wine, &c., should be used; the stimulation being graduated to the degree of depression or debility. In the cases of drunkards, wine or brandy should be allowed freely, as soon as the system begins to falter, and moderately at the commencement, even though it may be necessary to bleed at the same time. Chlorate of potassa has been usefully employed in the malignant epidemic erysipelas, or *black tongue*, by Dr. R. L. Scruggs, of Tennessee. (*Med. Exam.*, N. S., v. 227.)

When retrocession of the cutaneous inflammation takes place, if internal inflammation be the cause, bleeding should be employed as far as the patient can well bear it; but, if it be connected with debility, which probably happens quite as frequently, it will be necessary to stimulate. In either case, a blister, or an active rubefacient, as mustard, should be applied to the surface previously inflamed, and the whole body, if convenient, immersed in a hot bath.

During the exhaustion of the suppurative and gangrenous state, it is highly important to support the strength of the patient until the process is over: and quinia, the mineral acids, wine or the malt liquors, opium, and nutritious food, are the most suitable means.

In the periodical cases, the chief object of the physician, in the intervals, should be to discover any deviation from health to which the tendency may be owing, and to apply his remedies accordingly. It should, however, be borne in mind that the erysipelatous attack sometimes protects the system against a worse disease, and its prevention might, therefore, be a positive evil. It has appeared to me that the blood is probably in fault in some of these cases, and that, by altering the condition of that fluid, we might safely prevent the return of the disease. With this view, I have employed a diet exclusively of bread and milk for a considerable time, and with apparent benefit.

Mr. C. Hamilton Bell, of Edinburgh, treats erysipelas with the tincture of the chloride of iron, of which he gives from fifteen to twenty-five drops, every two hours, night and day, throughout the disease, without reference to the degree of fever, or the delirium. The only other treatment he employs is at first freely to act on the bowels, and afterwards to keep them properly open. His local applications are hair-powder and cotton wadding. He has used this method for more than twenty-five years with invariable success. (*Ed. Monthly Journ. of Med. Sci.*, June, 1851, p. 498.) Since the publication of Dr. Bell's paper, the remedy has been tested by many practitioners, and the reports have generally been in its favour.

The diet should be regulated in erysipelas, as in other febrile diseases.

Local Measures.—The head, or whatever other part may be affected, should be kept in as elevated a position as may be compatible with the comfort of the patient. An infinite diversity of local remedies has been proposed. Some doubt their propriety altogether, and prefer leaving the inflammation to nature, at best with only slight alleviating means. My own opinion is, that local measures are often of great use, but that they should be employed with some caution. The external affection is not the whole disease. If suddenly repelled by applications, the irritation may retreat with fatal effect to some interior organ. It is best, therefore, not to aim at its subversion, but only to regulate it; to check its advance when disposed to proceed too far, to diminish its violence when likely to lead to unpleasant results, and at all times to alleviate the uneasiness which it causes to the patient.

Perhaps, on the whole, the most comforting, alleviating, and least hazardous application, is that of some bland mucilage, kept constantly upon the inflamed surface, by means of soft folded linen thoroughly saturated with it. I usually prefer the infusion of slippery elm as being the most agreeable; but the infusion of sassafras pith or flaxseed may also be employed, especial care being taken that the flaxseed is not rancid. Should the inflammation be severe, advantage may accrue from the use of a solution of acetate of lead, in the proportion of a drachm or two to the pint of water. Slight narcotic impregnation of the liquids employed, as by acetate of morphia, infusion of opium, decoction of poppy heads or lettuce, may not be improper, though not likely to be very useful.

Should the inflammation be disposed to spread too far, and especially into inconvenient or dangerous positions, it becomes proper to arrest its course. This is especially necessary in facial erysipelas, when disposed to ascend into the scalp. It can very generally be accomplished by one of three measures; by blisters, nitrate of silver, or tincture of iodine. The last is probably, on the whole, the most convenient, and, where I have employed it, has generally answered well. A border, of an inch and a half or two inches in breadth, should be drawn across the path of the advancing inflammation, one half of the width to be upon the inflamed, and the other half on the sound skin. The tincture of iodine of the U. S. Pharmacopœia may be employed, and applied freely over the surface mentioned, so as completely to discolour it; and the operation may be repeated daily, if found necessary, until the inflammation begins to decline. The colour imparted by the iodine is soon dissipated, and the cuticle generally desquamates. Blisters may be employed in the same way, and they generally succeed, though more inconvenient than the iodine. Nitrate of silver is also very efficient, though the discoloration of the skin is of longer duration; and I should not be disposed to apply it upon the face. The most effectual plan is that of Higginbottom, who employs the stick itself, or a strong solution, made with eight scruples of the nitrate and twelve drops of nitric acid in a fluidounce of distilled water. Should the inflammation leap over the border formed in either of these modes, it will usually be with mitigated severity, and it may be often arrested by a repetition of the application upon the surface invaded.

Some apply the last mentioned remedies to the whole surface inflamed; and there may be cases in which the apprehension of gangrene might render this plan advisable; but, after the experience I have had, I fear it under ordinary circumstances. I have known blisters, applied in this way, to be followed by extensive ulceration of the skin.

Some allusion to other local measures which have been recommended may not be improper. Leeching has high authority in its favour. I fear, however, the ulceration of the bites, and seldom use them. To obviate this danger, it is advised to apply them to the sound surface in the vicinity of that inflamed. But, in the general predisposition to this form of inflammation, is there not some danger that the bites themselves may become new foci of the disease? The only circumstance which calls strongly for this remedy is, I think, the existence of some threatening internal inflammation or irritation, especially of the brain. Under the same circumstances, it might be proper to apply a blister to the nape of the neck.

A very common and simple application, more frequently used some years since than at present, is rye meal, or other dry, unirritating absorbent powder, plentifully sprinkled upon the inflamed surface. The object of the application is to absorb the acrid fluid, which sometimes exudes from the vesicles. It certainly alleviates, in some instances, the burning heat; but it is also liable to the inconvenience of forming hard crusts upon the surface. Whether it has any influence in reducing the inflammation is doubtful. Once, however, I enclosed a severely inflamed leg in a thick layer of this powder, with the apparent effect of immediately curing the inflammation. Possibly the result may have been a mere coincidence; possibly it may have been ascribable to the exclusion of atmospheric air.

Mercurial ointment at one time enjoyed much credit as a local application. Simple ointment or lard was afterwards found about as effectual. Perhaps they both act by excluding the air. Rayer, however, states that, in erysipelas of the face, he has often caused one side to be rubbed over with lard, and the other with mercurial ointment, and, on several occasions, one of these unguents was applied to one side, while the other was left untouched; and he never perceived that the disease was influenced by any of these proceedings. (*Diseases of the Skin*, Am. Ed., p. 69.) Some apply lard, with the addition of acetate of lead.

Solution of chloride of lime, in the proportion of half a drachm to a pint, solution of sulphate of iron and of corrosive sublimate, the liniment of Spanish flies (U. S. Ph.), raw cotton, and compression by means of a roller, are other means which are asserted to have been used with benefit. The application of cloths wet with ice-water has also had its advocates, and may be a useful measure in phlegmonoid erysipelas of the extremities. Dr. Trevor, of Illinois, has employed collodion as an external remedy with advantage. (*N. W. Med. and Surg. Journ.*, Jan. 1850.) The same substance mixed with one-fifteenth of castor-oil has been highly recommended.

Dr. C. D. Meigs, of Philadelphia, has found Kentish's ointment a very useful application in erysipelas, especially in that of new-born children. His mode of employing it is to render basilicon ointment soft, but not fluid, by the addition of oil of turpentine, and then to rub it on the part with the fingers. (*N. Am. Med. and Surg. Journ.*, vi. 77.)

Dr. P. Fahnestock, of Pittsburg, speaks in strong terms of the efficacy of creasote, as a local application, in different forms of erysipelas. He has never known the disease refuse to yield to this remedy. In the ordinary form of the complaint, it is generally sufficient to apply the purest creasote once over the whole surface inflamed, and somewhat beyond it, on the sound skin. The phlegmonous variety requires a more frequent repetition of the remedy. According to Dr. Fahnestock, the application should immediately whiten the surface. (*Am. Journ. of Med. Sci.*, N. S., xvi. 252.)

Deep incisions into the inflamed part have been employed with asserted benefit; and they are indispensable when the inflammation has extended beneath one of the fasciæ, and is producing organic mischief there. Another plan is that suggested by Dobson, and recommended by Bright, of making a very great number of minute punctures with the point of a lancet, and wiping off the blood as it flows.

When the erysipelatous surface is covered with small blisters, it is advisable to open them so as to prevent their communication, and the consequent loss of the cuticle before a new one has formed. When a raw surface is produced, in consequence of the separation of the cuticle, and seems indisposed to heal, it may be advantageously dressed with Goulard's cerate.

The progress of gangrene may sometimes, possibly, be arrested by a blister applied over the surface. After it has taken place, the parts should be covered with emollient dressings, to which creasote, pyroligneous acid, or solution of chlorinated soda or lime may be added, both to correct fetor, and as gentle stimulants.

Article XIII.

GLANDERS.

Syn.—Equinia (*Elliotson*).—Morve (*French*).

This is a malignant febrile disease, contracted by man from glandered horses, and characterized by a peculiar inflammation of the nasal passages, and a peculiar pustular eruption upon the skin, occurring either separately or conjointly, and attended in general by suppurating, bloody, or gangrenous tumours. In modern times, attention has been but recently attracted to the disease. Isolated cases were recorded by different writers in Germany, England, France, and Italy, between the years 1821 and 1830; but the first satisfactory account of it was given by Dr. Elliotson, in the latter of these years, in a paper published in the *London Medico-Chirurgical Transactions.* Subsequently, various contributions on the subject have been made to the journals; and several valuable treatises have been published, among which that of M. Rayer is probably the most elaborate.

The name of *equinia* was proposed for the disease by Dr. Elliotson, intended to express its derivation from the horse; as that of *vaccinia* was before given to cowpox. Dr. Shedel, in a dissertation contained in Tweedie's Library, adopts the name; but applies it also to a much milder affection, derived from the *grease* in horses, designating this by the title of *equinia mitis,* while he confers that of *equinia glandulosa* upon the glanders. The former is a trivial eruption of phlyzacious pustules, similar to those of ecthyma, which now and then occur on the hands of ostlers, &c., arising from the contact of an acrid discharge, proceeding from the heels of horses affected with the disorder of the feet called grease. The eruption is attended with slight febrile symptoms, runs a course of ten or twelve days, then begins to decline, scabs, and ultimately disappears, leaving small well-defined scars. It occasions little inconvenience to the patient, and is without danger. It does not bear the least resemblance to the malignant affection now under consideration; and the mere circumstance of originating from the horse, would scarcely seem to entitle it to the same designation, however qualified by epithets. The general adoption of one generic name for the two complaints might lead to the injurious impression, that they were but different grades of the same affection.

The disease which forms the subject of the present article has been called *simple glanders,* when it affects the nasal passages especially, and *farcy glanders,* when attended by an eruption of small suppurative and ulcerative tumours, such as are denominated *farcy* in horses. But, though cases may occur with these distinctive marks, yet in most instances the symptoms are commingled; and, as both forms have the same cause, are equally destructive, and, so far as known, require no difference of treatment, there does not seem to be any necessity for separating them. A great difference has been noticed in the duration of the disease in different cases; and authors are generally agreed in treating of it under the two heads of acute and chronic glanders.

Symptoms of Acute Glanders.—When the disease has been imparted by accidental inoculation, in a period of time varying from two or three days to a week, inflammation occurs at the point where the poison was applied, and extends more or less along the absorbents, and into the neighbouring cellular tissue, with the occurrence of febrile symptoms. Sometimes, however, there is little or none of this preliminary affection, and sometimes, after having taken place, it subsides before the characteristic phenomena show themselves. In many instances, the disease commences without any apparent local cause, as if contracted through the atmosphere.

The first symptoms are those of an attack of fever, such as general uneasiness, languor, weariness, rigors, sometimes nausea and vomiting, headache, &c., followed by a frequent pulse, hot dry skin, thirst, and a furred tongue. Along with these are acute pains in the joints, generally confined to the limbs, but sometimes affecting the trunk, bearing a close resemblance to those of rheumatism, for which they have in some instances been mistaken. These pains are among the most characteristic phenomena of the earliest stage, and occasionally precede for a considerable time the occurrence of other symptoms. Portions of the skin over the painful joint or joints, or upon the face, become red as in erysipelas; but soon assume a violet colour, and show the bad tendencies of the disease by vesicles and patches of gangrene.

At a variable time from the commencement of the attack, usually, perhaps, in about a week, an eruption of phlyzacious pustules takes place, most abundant on the face and limbs, about the size of the vaccine vesicle, having frequently a small red areola, sometimes umbilicated, and presenting occasionally a dark purple hue. They occur in successive crops, and appear, therefore, in different stages of progress at the same period of the disease. Dr. H. Graves, of Dublin, observed a white zone about the pustules in two cases, and considers this as characteristic of the disease. Along with these pustules are gangrenous bullæ, especially on the face and scalp; prominent ecchymoses filled with a reddish sanies, and having sometimes a gangrenous base; and tumours from one to three inches or more in diameter, which are at first hard and painful, but soon suppurate, and form abscesses extending into the subcutaneous cellular tissue, and often deep into the substance of the muscles.

At a still later period, sometimes not until a few days before the close of the complaint, the nostrils begin to discharge a mucous or purulent fluid, which is at first yellowish, afterwards dark from the admixture of blood, and often extremely offensive. In some instances, it is thin and sanious, but more frequently viscid and tenacious, adhering to the sides of the nostrils and to the upper lip, forming characteristic crusts, and excoriating the parts which it touches. Sometimes this secretion flows back into the fauces, and, being swallowed, does not appear externally. The nostrils are more or less obstructed by the swelling of the membrane, even before the occurrence of the discharge, and become still more so afterwards, so as much to impede respiration. Gangrenous openings sometimes take place in the cartilaginous septum, so that a probe may pass from one nostril into the other. In certain cases, the discharge makes its appearance early in the disease; and in most, it is probable that, long before its occurrence, a close examination would exhibit evidences of inflammation in the Schneiderian membrane. The salivary glands are occasionally swollen; the mouth and fauces are inflamed in spots or patches; and the larynx, in some instances, so much participates in the disorder as to endanger suffocation by the closure of the glottis. The lungs are not unfrequently involved, and a cough occurs with rusty or adhesive expectoration.

The face exhibits in a peculiar manner the ravages of the disease. The nose is red and swollen; a gangrenous inflammation extends to the lips, eyelids, and forehead; one or both eyes are closed by tumefaction; and eschars form, surrounded by a dark red or livid edematous border, with awful mutilation of the features.

The general symptoms are in accordance with these local phenomena. The skin is hot; the tongue dry and coated; the respiration hurried or laborious and sometimes stertorous; the pulse frequent, small, and feeble. There is often extreme thirst. Diarrhœa is an almost constant symptom, with frequent, offensive discharges. The body exhales a fetid odour. The mind wanders, and delirium alternates with coma. At length involuntary discharges and extreme prostration indicate the immediate approach of death. The duration of the disease varies in general from two to three weeks. Sometimes death takes place earlier than the former period, from some incidental cause, such as closure of the glottis, and occasionally it is postponed to the end of the fourth or fifth week.

The symptoms enumerated do not all occur in every case, nor always in the order stated. In some instances, the nasal phenomena predominate, in others, the carbunculous or eruptive; and one of these sets of symptoms may occur to the exclusion of the other. But, whatever may be the precise course of the acute complaint, the event is almost invariably the same. The patients nearly all die. In only a few cases, and those either very mild or of doubtful nature, is recovery reported to have taken place.*

Symptoms of Chronic Glanders.—The cases which have been recorded as belonging to this variety of the affection are comparatively few, and its history is less satisfactorily made out than that of the acute form. Nevertheless, there seems no good reason to doubt that the complaint does occasionally assume a chronic character. In the mildest cases, the symptoms are sometimes confined to the nasal passages and the communicating cavities, from which an offensive discharge issues, sometimes glutinous, sometimes purulent or sanious. This form of the disease may get well under treatment; in which case, unless its origin be very clearly traced, its nature must always remain doubtful. In other instances, after a variable duration of several months, the nasal affection becomes complicated with tumours, acute symptoms supervene, and the patient speedily perishes. Instead of being at first restricted to the nostrils, the complaint may show itself by pains in the joints, with spots of redness on the limbs, and suppurating tumours, which may continue for months, and at length, becoming complicated with disease of the nostrils, may run on to a fatal termination. There have been no instances of chronic glanders, in which the peculiar pustular eruption has existed.

Anatomical Characters.—Besides the external lesions which are evident during life, dissection reveals bloody infiltration, gangrene, and suppuration of the cellular tissue; abscesses in the muscles; thickening, softening, and redness of the Schneiderian membrane, which is covered with a grayish mucus, and is studded with numerous minute yellowish elevations, of the size of a small shot, sometimes isolated, sometimes clustered, and filled with pus or a thick lymph; ulceration and gangrene of the same membrane, with denudation and caries of the bone, and sometimes an opening through the septum; the same eruptive appearances, to a certain extent, in the soft palate and the fauces; tumefaction of the glottis; and abscesses in the lungs, or more frequently the marks of lobular pneumonia abundantly diffused through those organs. The alimentary canal, the heart, and the large interior glands, are not prominently affected. The blood retains its coagulability, and does not present the dark tarry appearance sometimes observable in malignant fevers.

Cause.—The cause is well ascertained to be a poison generated in the horse, and other animals of the same genus, as the ass and mule, affected with glanders. The disease is imparted either by contact of the poisonous secretion with some abraded point on the surface; by its introduction into the stomach, as when the patient has drank out of the same vessel with the animal; or through the medium of the atmosphere, though this last mode of communication is somewhat doubtful. Persons have been affected with it who have lodged in the same stable, or been otherwise in close communication with the diseased animal, without being able to trace it to direct contact of the matter with an abraded spot. The case of a woman is recorded who was supposed to have been attacked from working among horse-hair. Others have suffered in consequence of washing the linen of persons affected with the disease, showing that it is communicable from man to man. It appears that few individuals are susceptible of glanders; for the proportion of those who have been attacked after exposure is extremely small. It is said that the persons affected have generally been of intemperate habits, or of constitutions otherwise debilitated.

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* See *Archives Gén.*, 4e sér., xiv. 89; xviii. 222; and xxvii. 419. For cases described by Dr. F. W. Mackenzie, see the *Lond. Journ. of Med.* for Sept. 1851, p. 789, and the *Lond. Med. Times and Gaz.* for July, 1852, p. 7. Neither of these cases can, I think, be considered as undoubted examples of the disease; and still less a third case, in which a cure took place, described in the last mentioned Journal for March, 1854, p. 308.

Treatment.—In relation to the acute disease, the methods of treatment hitherto employed having proved almost invariably unavailing, it is scarcely worth while to occupy space by detailing them. The practitioner must be left to the guidance of his own medical principles. Having had no experience in the complaint, I do not feel authorized even to offer suggestions. In a case of supposed glanders recorded by Dr. Mackenzie, which ended favourably, the treatment consisted in an emetic dose of ipecacuanha, followed by five grains of the carbonate of ammonia every two hours, the use of wine or porter, an opiate at night, nourishing food, a small quantity of the blue pill, and a gargle of solution of chloride of lime. In the chronic affection, Dr. Elliotson found advantage from the injection of a solution of creasote into the nostrils, while the same medicine was given internally. Two cases in which only one nostril and the frontal sinuses were affected, are stated by him to have yielded to this remedy. Another case, which recovered under the care of Mr. Travers, was treated chiefly with emetics.

Article XIV.

DENGUE.

Syn.—Breakbone Fever.—Dandy Fever.—Dunga.

By the above names has been designated a peculiar febrile disease, characterized by the presence conjointly or separately of rheumatic symptoms and cutaneous eruption, and always, so far as has been observed, occurring epidemically. The first notice of it is contained in an account by Dr. Rush of an epidemic which prevailed in Philadelphia, in the summer and autumn of 1780, and which he described under the name of "bilious remitting fever," stating, at the same time, that it was commonly called "breakbone fever," in consequence of the violence of its attendant pains. (*Medical Inquiries and Observations*, 3d ed., ii. 385.) In 1824, the disease prevailed at Calcutta, and was described by Dr. James Mellis, in the *Transactions of the Medical and Physical Society* of that city. (*Am. Journ. of Med. Sci.*, iv. 495.) Towards the close of 1827, an epidemic broke out in the West Indies, whence it proceeded to the continent, reaching New Orleans in the Spring, and Charleston and Savannah in the summer and autumn of the following year. It was to this that the name *dengue* was first applied, the origin of which is somewhat uncertain, though it is supposed to be a Spanish corruption of the word dandy; the name of *dandy fever* having been jocosely conferred on the disease by the negroes of St. Thomas, where it first appeared, from the stiff carriage of those affected with it. Various accounts were given of this epidemic, of which the most satisfactory are probably those of Dr. S. H. Dickson, who described it as it appeared in Charleston (see *Bell's Library* for 1839), and Dr. Wm. R. Waring, whose communication in relation to it appeared in the *North American Medical and Surgical Journal* (ix. 374). According to Dr. Waring, the disease first appeared in Savannah in the autumn of 1826, and prevailed to a certain degree in the following year; but the Spanish name dengue was not applied to it until the attack of the epidemic in the autumn of 1828. For a long time after this period nothing was heard of it; but in the summer of 1850 it again visited the South, and Charleston suffered from it with special severity. A history of the epidemic, as it prevailed the second time in that city, was communicated to the *Charleston Medical Journal* for November of the same year, by Dr. S. H. Dickson; and it is from the published accounts of that author, and of Dr. Waring, that the following summary has been chiefly drawn. I have had no opportunity of seeing the disease.

Symptoms, Course, &c.—In many cases, the complaint comes on gradually; but in the greater number its commencement is somewhat abrupt, though there is seldom a regular, well-formed chill. The first symptoms are usually headache with intolerance of light, general uneasiness, restlessness, sometimes more or less chilliness, a sense of great debility, and violent pains in the back, limbs, and joints, attended often with some degree of tumefaction, and with soreness and stiffness of the muscles, very much resembling rheumatism. The small as well as the large joints are affected, and sometimes the pain is first felt in the thumb or fingers. It is occasionally confined to one part, but seldom; and when it attacks several parts, may seize upon them all at once, or successively. In some cases it affects the stomach and bowels. The skin soon becomes hot and dry, the pulse increased in frequency, the face flushed, and the eyes red and watery. The tongue, however, though red, is usually clean at this stage. Sometimes a rash or papular eruption appears, but not generally at this early period of the disease. Not unfrequently the patient exhibits drowsiness, which may continue in greater or less degree throughout the complaint. Children are sometimes attacked with convulsions, and pregnant women are apt to miscarry. Painful swellings of the lymphatic glands in the neck, axilla, and groin, and of the testicles, occur in some cases, and continue after the subsidence of the other symptoms. The initial fever lasts from twelve hours to three or four days, perhaps, on the average, about a day and a half; after which it subsides, leaving the patient much more comfortable, but often very feeble. Then follows an interval of two, three, or four days, during which the patient is without fever, and suffers less from the pains, though he still complains somewhat of rheumatic sensations, and of general weakness. On the fourth or fifth day, there is often a return of the fever and pains, and the tongue now becomes thickly coated. In some instances, however, there is no febrile heat or frequency of pulse, but severe pain in the head. Nausea and epigastric uneasiness are prominent symptoms, but the patient seldom vomits. On the fifth, sixth, or seventh day, an eruption usually appears, more especially upon the upper portion of the body, and gives relief to the symptoms of internal irritation. This eruption is extremely variable in character, being sometimes smooth, red, and continuous, as in scarlatina; sometimes in patches, rough, and of a darker hue, as in measles; and occasionally, also, either papular, vesicular, pustular, or furunculous; and often there is a mixture of two or more of these forms. Cutaneous affections like urticaria and erysipelas are also occasionally observed; and even carbuncles occur. In some few instances, the eruption assumes the petechial character; the gums are red, spongy, and bleeding; and soreness of the mouth, with ulcers, complicates the case. The cutaneous affection is attended usually with heat and itching. Upon subsiding, it is sometimes followed by a furfuraceous or scaly desquamation. The complaint gradually subsides, leaving the patient for the most part with some rheumatic stiffness or soreness for a longer or shorter period, and with feelings of weakness, and occasionally of mental depression. Sometimes the debility is very considerable, and even alarming, with a slow, weak pulse, cold sweats, and a purplish or livid appearance of the eruption. The duration of the affection varies with the length of the remission, but on the average, is about eight days. Sometimes the cases are much milder; and, as in other epidemics, there is every grade, from a scarcely observable disorder to the greatest intensity of which the disease is susceptible.

The course of symptoms above detailed bears a considerable resemblance to that of yellow fever; and the two affections have sometimes been confounded. The persevering rheumatic symptoms, and the cutaneous eruptions are, however, sufficiently diagnostic of the dengue. It is not improbable that the causes of the two affections may sometimes prevail at the same time: in which case, the yellow fever may take on some of the characters of this peculiar epidemic, and the diagnosis be rendered more difficult. Another striking distinction between the two diseases is the great difference in their results. The yellow fever is very often fatal, the dengue almost never.

Cause.—No other cause of this affection is known than epidemic influence. It has been ascribed to contagion; but the proofs of this are insufficient. Contagious affections do not so rapidly disappear without leaving traces behind them. Besides, it is stated that, when families are attacked, it is not a single member of the family that is first affected, and afterwards at a certain period several others; but almost all are seized at once, or in rapid succession, so that there are not enough well to attend on the sick. This epidemic differs from almost all others in the numbers affected in proportion to the population. The great majority of the people usually suffer. The epidemic which in this respect most nearly resembles it, is the influenza. It attacks indiscriminately persons of both sexes, of all colours, and of all ages from earliest infancy to extreme old age. The period of incubation is extremely variable, being in some instances, as asserted, so short as twenty-four hours, and extending in others to ten days.

Prognosis.—This is almost always favourable. Perhaps no disease with so much severity of symptoms is so seldom fatal. When death occurs, it is almost always in consequence of some incidental complication, or of the great previous weakness of the patient, as in very advanced life.

Treatment.—Where all the patients recover, treatment is to be employed simply to palliate and alleviate. An emetic, administered at the very earliest period, is said sometimes to have arrested its progress; but so disagreeable a remedy will probably not be generally resorted to in an affection attended with so little danger. Some gentle aperient may be given early in the attack, and subsequently if the bowels should be confined. When the skin is hot and dry, the neutral mixture or other refrigerant diaphoretic may be administered. In very violent cases of headache, a small bleeding has been recommended as affording relief. But the most important remedies are anodynes, to relieve the exquisite pains. Of these opium is the most efficient. It may be given in any quantity requisite to produce the desired effect, so that it do not occasion stupefaction. When there is no nausea, it is probably best given in the form of Dover's powder. In light cases, the camphorated tincture of opium is sufficient. The warm bath might be expected to afford relief. It is often advisable to counteract the depressed state of the system by stimulants, as by wine, the malt liquors, or even brandy; and nutritious food should be given at the same time. Some practitioners treated their patients on the expectant plan; prescribing rest, a recumbent position, cold to the head, hot pediluvia, and a regulated diet.

CLASS II.

CONSTITUTIONAL DISEASES.

The above title does not exactly designate the diseases belonging to this class. It is used, for the sake of brevity, with a somewhat arbitrary application. As already stated (*page* 232), the second class embraces constitutional affections, which may display themselves in local disease of any part of the system, but not in all parts at the same time. This want of universality excludes them from the first class; and, as they frequently occupy several different organs at once, and may pass from one organ to another during the same attack, they cannot be placed in the category of affections strictly local.

The only diseases which I place in this class are rheumatism and gout. There are others that properly belong to it, but, for convenience sake, are considered elsewhere. One of these is scrofulous or tuberculous disease. This is certainly a constitutional affection, and may show itself in any one part, or in many parts of the system, at the same time. But the local affections are of so fixed a character, are in some instances so strongly marked, and are so universally looked upon as constituting distinct diseases, that they are advantageously described rather in reference to their position than their nature. Hence, I have treated of what concerns the disease generally under general pathology, and propose to treat of its local exhibitions, as phthisis, external scrofula, mesenteric disease, &c., among the local affections belonging to the third class. The same remarks are applicable to carcinoma or cancer, and to melanosis. Syphilis, in its advanced stages, would also be attached to the present class, were it admitted into this work; but it is so generally considered as a surgical disease, and so fully treated of by surgical writers, that it may be omitted, without inconvenience, in a treatise upon the practice of medicine. With regard to rheumatism and gout, it may be thought that the fever which attends them should rank them in the first class; but fever is not a necessary accompaniment of these diseases; and, when it occurs, is probably in general secondary, and dependent on the local affection.

Article I.

RHEUMATISM.

Syn.—Rheumatismus.

Rheumatism (from ῥεῦμα, *rheum* or *flux*) is a constitutional affection, attended with a peculiar irritation or inflammation, to which all parts of the system are liable. Its general characters might have been described, in the first part of this work, under the heads of irritation and inflammation, as one of the specific forms of these affections; while its appearance in particular parts, organs, or tissues might have been reserved for the department of special diseases. But it so frequently occupies many parts, at the same time or successively, in the same attack, and presents so strong an individuality in whatever part it may exist, that it is most conveniently considered as one disease wherever it may appear, and therefore as belonging to this section of the work. It was formerly confounded with gout, under the common designation of arthritis; and, according to Dr. Chapman, the application to it of the name rheumatism first occurs in Ballonius's treatise, "*De Rheumatismo*, &c.," published in Paris in 1642. It is considered by most writers to be peculiar to some one, or to a few of the tissues, as the fibrous, muscular, and serous. I believe that it may affect one or all of them; and proofs of the fact will, I think, be afforded in the following pages.

Rheumatism may be divided, according to its seat, or its grade of excitement. Thus, some writers treat of it under the heads of articular and muscular rheumatism, the former occupying the joints, the latter the muscles; but the fact is, that, though the disease is often situated exclusively in one or the other of these parts, it yet quite as frequently occupies both, to a greater or less extent, in the same attack. A better division is that founded upon difference in grade; and, for convenience of description, the four following varieties may be recognized:—1. *the acute*, in which violent local inflammation is attended with considerable constitutional disturbance, or fever; 2. *the subacute*, in which the inflammation is less violent, and there is little or no fever; 3. *the chronic*, which is characterized by long duration, and the lowest grade of inflammatory action; and 4. *the nervous*, in which there is neither inflammation nor fever, the disease consisting exclusively in irritation, and that directed especially to the nervous tissue.

1. *Acute Rheumatism.*

Symptoms, Course, &c.—Fever invariably attends this form of the disease. It is said sometimes to precede the inflammation; but this event is rare. The primary symptoms are generally local. In the great majority of cases, they show themselves in the extremities, and usually first in the lower. The disease may be confined to a single joint, or to a part or the whole of one limb; but much more frequently it affects several limbs, and different portions of the trunk, jointly or successively; and occasionally it involves almost the whole exterior of the body. It has been observed, however, that, when this last event occurs, one side of the body is more severely affected than the other. The small joints, as those of the fingers and toes, are less frequently inflamed than the larger, as the ankle, knee, wrist, and elbow.

Sometimes the complaint begins with a feeling of uneasiness or stiffness in the part, which soon amounts to soreness or positive pain, especially upon motion. In other instances, the first symptom is acute and violent pain. Heat and swelling soon come on; and, when the pain has been sharp and lancinating, it is very commonly moderated after tumefaction. Extreme soreness, however, remains, and the slightest movement of the part occasions suffering. The swelling is usually tense and elastic, and the surface often reddened, with a light rose colour gradually shading off into that of the healthy skin; but, in many instances, the natural colour is in no degree altered.

Commencing generally in one part, the inflammation quickly extends to others, as from the ankle to the knee, or from the ankle or knee of one side to the corresponding joint on the other; then to the wrist or elbow; sometimes in its progress attacking neighbouring parts, sometimes distant parts in succession; and often declining or disappearing in one seat, after fixing upon another. The swelling of the deserted joint does not immediately subside with the pain, but usually becomes softer, and, instead of being firm and elastic, will often pit somewhat upon pressure. Not unfrequently, a joint is attacked a second time, and occasionally a third or fourth time, or even more frequently, before the disease ends. In some cases, the inflammation is confined chiefly to the neighbourhood of the joints; in others, it affects more especially the muscles; in others again, both structures are involved, and indeed all the tissues; the whole limb being swollen, tense, and extremely tender. In the joints, the disease may be confined to the ligaments, or may affect also the synovial membrane. In the former case, the swelling is firm and elastic, in the latter often somewhat soft and fluctuating, in consequence of the increase of the synovial secretion. The latter condition is especially observable in the knee, where fluctuation may be perceived on each side of the patella. The swelling is usually greater in the more superficial joints, as the ankle, knee, and elbow, than in those more protected by muscles, as the hips and shoulders. In severe cases, the suffering is often very great. The pains, which are scarcely ever entirely absent, are at times almost excruciating, being described as tearing, rending, &c.; and the slightest movement, or the least jar or pressure, produces so much suffering that the patient does not dare to change his position, and dreads the approach of any one to his bed.

Very soon after the local seizure, rigors and other symptoms of commencing fever are experienced, followed by increased frequency of pulse, heat of skin, furred tongue, anorexia, thirst, and occasionally headache. The fever is almost always of the asthenic character, and generally of a violence proportionate to that of the local affection, though not invariably so. The pulse is full, strong, and usually not very frequent, varying from ninety to a hundred and ten, and probably, in the greater number of cases, not exceeding a hundred. Respiration is not sensibly disturbed, while the disease confines itself to external parts. The surface, though warm, is less heated than in most other fevers, and is often moist, sometimes indeed bathed in copious sweats, which have a peculiar sour and sickening smell, and have no effect in relieving the inflammation or pain. The tongue is usually moist, and thickly covered with a whitish fur. There is seldom nausea or vomiting. The bowels are generally constipated, and sometimes obstinately so. The secretions are little diminished, with the exception of the urine, which is scanty, high coloured, and disposed to let fall lateritious sediments upon cooling. The brain is usually remarkably exempt from disorder; the patient being seldom delirious, though not unfrequently deprived of sleep by the violence of his pains. I have, however, seen delirium a prominent symptom, without any reason to suspect positive cerebral inflammation. The fever is usually remittent, with exacerbations in the evening, which are often accompanied with an increase of the pains. These are consequently worse at night, and relax somewhat with the fever in the morning.

The disease may run its course, and very often does so, without penetrating any of the great cavities. But often, also, either by a simple extension, or by a metastasis of the inflammatory action, various internal organs become affected, and the case very seriously complicated. The most frequent of these complications is inflammation of the lining and investing membranes of the heart, constituting endocarditis and pericarditis. The fact that serious organic disease of the heart occasionally originates in rheumatism, and even the peculiar liability of the cardiac membranes to become inflamed, have been long known to the profession; but Bouillaud was the first to prove the frequency of the affection, and its existence in many cases in which the ordinary symptoms would not have indicated it. According to that author, it occurs in the great majority of cases of acute rheumatism. Dr. Wm. Budd states that, out of forty-three cases of which he preserved accurate notes, the symptoms of rheumatic inflammation of the heart were unequivocal in twenty-one, of which five were pericarditis. (*Tweedie's Syst. of Pract. Med.*) I am convinced that this is a much larger proportion than occurs in this country. Probably our energetic practice in acute rheumatism may be one cause of the difference. According to Dr. Budd, the period at which the cardiac disease comes on varies from the eighth to the twenty-seventh day; and, though it is stated by Dr. Fuller that it occurs at all stages, and sometimes even precedes the inflammation of the joints, yet there can be no doubt of its greater frequency at a somewhat advanced stage of the disease.* With us, acute rheumatism often terminates within the limits stated by Dr. Budd, and probably before the time at which the inflammation of the heart would ensue, were the case to run its natural course. Endocarditis is much more frequent than pericarditis; and, when the latter occurs, it is very apt to be accompanied by the former. In the great majority of cases, both affections yield to proper remedies. Pericarditis is more immediately dangerous, endocarditis leaves the most unpleasant effects behind it. In the former, the two surfaces of the pericardium often coalesce in case of recovery, and no disagreeable consequences ensue. In the latter, if not cured, disease of the valves is apt to remain, which is followed in time by hypertrophy and dilatation, and ultimately by death. For further details in relation to these affections, their symptoms, physical signs, anatomical characters, and results, the reader is referred to *Diseases of the Heart.* It may be proper in this place to state that, whenever, in the course of acute rheumatism, pain and oppression in the precordial region, difficult or hurried breathing with or without cough, palpitation, increased frequency of pulse, and an anxious, disturbed, or peculiar expression of countenance, supervene, disease of the heart may always be suspected; and a close examination should be made, by means of auscultation and percussion, into the condition of that organ and its membranes. The cardiac affection may, indeed, occur without announcing itself by any of these symptoms, and, in its earlier stages, may entirely escape the attention of the practitioner, unless sought for by the means alluded to. It should, however, be stated here that some caution is to be observed not to draw too hasty a conclusion, as to the existence of endocarditis, from the circumstance that cardiac murmurs are heard in auscultation; for it is probable that they sometimes arise from the deposition of fibrin from the highly fibrinated blood, independently of inflammation of the endocardium; and it is well known that they are frequent attendants on an anemic state of the blood, which is not uncommon in acute rheumatism, especially in its advanced stage. In general, the occurrence of endocarditis or pericarditis is not attended by any material abatement of the external inflammation, so that they must be looked upon as an extension, and not as a transfer of the disease. A case, however, of acute rheumatism in a young lady occurred to me, in which a retrocession of the inflammation from one of the lower extremities was followed by disease of the heart, which proved fatal in a few days. Either there was metastasis here, or the concentration of a powerful excitement in the central organ called off the disease from the limb upon the principle of revulsion. It is said that rheumatism, affecting the ligamentous structure of joints, is more apt to extend to the heart than the same affection, seated in the synovial membranes. Children, when affected with inflammatory rheumatism, are much more liable to this complication than adults; and in relation to the latter, the liability appears to diminish with the age. Women are said also to be more frequently affected than men.

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* See *Treatise on Rheumatism*, &c., by Dr. Henry William Fuller, Am. ed., 1854, p. 165.

Next to the membranes of the heart, the pleura is probably the most frequent seat of internal rheumatic inflammation. Pleuritis, however, seems, in most cases, to be an extension of the cardiac disease, or at least to occur simultaneously with it.

Sometimes the brain or its investing membranes are affected. There is reason to believe that the disease is seated more especially in the membranes, though an irritation is undoubtedly propagated to the cerebral substance. Disease of the heart has generally of late been observed in these cases, and the cerebral affection has been considered by some as depending upon the cardiac. The probability is, that the two are mere coincidences, depending upon a common cause. Pain in the head, with increased sensibility to light and sound, delirium, and coma, are signs of the extension of rheumatism to the brain. The use of large doses of quinia in acute rheumatism is said to have occasioned this complication, in some instances.

The peritoneum is said to be sometimes though rarely affected. I do not remember to have witnessed an instance of the kind. Occasionally, violent affections of the stomach and bowels supervene in rheumatism, but oftener, I believe, in other forms of it than in the acute. The same may be said in relation to the kidneys. (See *Subacute* and *Nervous Rheumatism.*)

A variety of acute rheumatism denominated *bilious* has sometimes been noticed, especially in miasmatic districts. Its peculiarities may be dependent upon two causes. The transfer or extension of rheumatic irritation to the liver may derange the functions of that organ, giving rise in some instances to bilious vomiting from an excess of secretion, in others to yellowness of the tongue, conjunctiva, and skin, with bilious urine and clay-coloured stools, from a suspension of the secretion, as in jaundice. (See *Jaundice.*) But more frequently, the rheumatism is coincident with an attack of intermittent or remittent fever, and exhibits, along with its own peculiar phenomena, the bilious symptoms and paroxysmal character of those affections.

The disease occasionally assumes an *adynamic* character, marked by diminished force and increased frequency of pulse, copious sweats during sleep, a feeling of great debility, and a more than ordinary tendency to metastasis. The symptoms, however, are seldom or never of that peculiar kind denominated typhous.

The duration of acute rheumatism is uncertain. By proper remedial measures it may frequently be arrested in a week or two; but sometimes it runs on for six weeks, two months, three months, or even longer. Perhaps from ten days to three weeks is the ordinary duration under judicious treatment from the beginning. In its course it not unfrequently exhibits alternations of amendment and aggravation; and sometimes, when everything promises fairly, the disease resumes, without obvious cause, all its original violence. In some cases, it appears like a succession of local attacks in different parts, each running a course of a week or ten days, and not unfrequently recurring again and again in the same part. In any one position, a decline of the disease is indicated, first by the diminution or disappearance of the pain, then by a softening of the part, so that, instead of being tense and elastic as at first, it will not unfrequently retain for some time the impression of the finger, and lastly by a gradual subsidence of the swelling. When the general disease is about to give way, new accessions of inflammation cease, or, if they occur, exhibit a much milder character; the violence of the pain everywhere subsides; the patient loses his excessive sensibility to impressions from without, and the febrile symptoms are moderated or disappear. Some swelling and soreness are apt to remain, for a considerable time, after the violence of the disease is passed; and weakness and stiffness of the joints and muscles are frequently left, after convalescence has been long established. In some cases, the febrile movement does not cease with the obvious inflammation, being kept up probably by some lurking affection of the internal organs, possibly by inflammation of the inner coat of the arteries. On the contrary, more or less local disease is not unfrequently left after the fever has gone, and the acute degenerates into chronic rheumatism.

Anatomical Characters.—The blood abounds in fibrin, and almost always exhibits the buffy coat when drawn during life, and allowed to coagulate. Indeed, with the exception of pneumonia, there is no one of the phlegmasiæ in which these characters exist so strongly as in acute articular rheumatism. In one instance, Andral and Gavarret found in 1000 parts of blood, 10.2 parts of fibrin, the healthy standard being 3. But it is only during the existence of the acute pain and fever that this excess is so striking. The proportion after their disappearance, though swelling and soreness may remain, is sometimes below the healthy mean. Dr. Garrod found in the blood of acute rheumatism no more uric acid than exists in that fluid in health, that is, only a trace (*Lond. Med. Gaz.*, Feb. 1848); and, since this statement was originally made, it has been repeated after the examination of a great number of cases. (*Ibid.*, July, 1854.)

After death, the synovial membranes have been found red and thickened, and the liquid in their cavities simply increased, without material alteration of character. In some rare instances, however, pus has been observed in the joints, and, still more rarely, false membrane and albuminous flocculi. The fibro-cartilages have also exhibited evidences of inflammation in softening and erosion. Urate of soda does not appear to have been, in any instance, detected in the joints. The muscles affected by the disease have presented a dark-red colour, with softening, and the effusion of a bloody serum into their interstitial cellular tissue. Signs of inflammation have also been noticed in the lining membrane of the arteries. The internal inflammations attendant on the disease leave the same effects behind as under other circumstances.

Causes.—Almost the only known exciting cause of acute rheumatism is cold. Moisture increases its effect, but, in all probability, only by serving as a more rapid conductor than the dry air. The cold operates most powerfully during perspiration from previous exercise or exposure to heat. Sleeping in damp sheets or upon the damp ground, the wearing of wet clothes, exposure to cold rains without subsequent change of dress, and sitting in a damp, cold room, are examples of the kind of exposure which is apt to be followed by the disease. From a knowledge of the cause of rheumatism, it would be inferred that the complaint must be most prevalent in damp, changeable climates, and, as relates to the seasons, in the latter part of autumn and in spring.

But something more is requisite than cold. There must also be a peculiar state of system predisposing to this form of disease. There must be a rheumatic diathesis. In what this diathesis consists has not been discovered. There are no signs by which its existence can be detected, with an approach to certainty. Large jointed, muscular, and lank frames are probably more frequently affected than those of opposite characteristics. Men are more subject to the disease than women, but in all probability, because more exposed to vicissitudes of temperature. The predisposition is certainly much affected by age. Children under ten years, and adults over sixty, are seldom attacked; and the period of life at which the disease is most prevalent is probably between fifteen and thirty-five or forty. Among the most powerful predisposing causes of the disease is a previous attack of it. At least, persons once affected are more liable to the complaint afterwards than they had previously been;

and, when it occurs in the old, it is almost always in those who have been attacked at an earlier period of life. I think it is no less certain that a predisposition to the disease is often inherited. It is very apt to exist in members of the same family, whether inherited or not. Debility appears to favor the predisposition; though full and vigorous health does not afford protection. The diathesis, when strong, is alone sufficient to generate the disease, without the aid of exciting causes.

Diagnosis.—Gout is the only complaint with which acute rheumatism is liable to be confounded; and from this it is in general readily distinguished. The same, however, cannot be said of some other forms of rheumatism. The diagnostic symptoms will be more conveniently given under the head of gout.

Prognosis.—Acute rheumatism, though an exceedingly painful disease, is in adults very seldom immediately fatal, and, if properly managed, rarely leaves any fatal effects behind it. If uncomplicated with the internal inflammations alluded to in the account of the symptoms, it may almost always be conducted to a favourable issue. Of these complications, the cerebral, though comparatively unfrequent, is probably, in proportion to the number of cases in which it occurs, most fatal. The dangers to be apprehended from endocarditis and pericarditis have been already alluded to. I cannot, however, avoid expressing my conviction, that these dangers, so far as acute rheumatism is concerned, have been greatly exaggerated in some recent practical treatises. I do not remember to have met with more than a single case of fatal affection of the heart in adults, either during or subsequent to an attack of acute rheumatism, which I had the opportunity of seeing in its earlier stages. In children, however, the case is otherwise. In these, though the complaint is comparatively very rare, it is always dangerous, in consequence of its tendency to give rise to a condition of the heart, ending in fatal hypertrophy and dilatation.

2. *Subacute Rheumatism.*

Very many cases of rheumatism occur, so limited in extent, and attended with so little constitutional disturbance, as to have no claim to be ranked with the acute variety; while their brief duration excludes them from the chronic. These are embraced in the division at present under consideration. As in the preceding variety, the disease may in this affect either the muscles or the joints; but, while in the acute the joints are most frequently affected, in the subacute, the precedence belongs to the muscles.

Symptoms, Course, &c.—Two or more joints may be inflamed; but, in probably the greater number of instances, the disease is confined to one at a time; as, with the grade of action often present in these cases, an extension to several of the articulations simultaneously would give rise to decided fever, and thus constitute acute rheumatism. The local symptoms are not materially different from those described under the preceding variety. The pain, however, is usually less severe, amounting often only to slight aching or soreness. There is also less redness and heat, and the swelling is less tense and elastic. There is sometimes increased secretion of the synovial fluid, and that of the bursæ, and fluctuation may be noticed in the vicinity of the joint, especially the knee.

In the muscular form, as in the articular, the disease may extend to several muscles, or be limited to one. It very frequently extends to several in the same neighbourhood, and concerned in the same office. In some instances, there is at first a feeling of soreness, which gradually increases until it amounts to a dull aching pain, which becomes acute when the muscle contracts. In others, the patient first becomes sensible of the complaint by a very severe sharp lancinating pain, which seizes the muscle upon some occasion when it is suddenly called into action, as upon attempting to rise from the sitting posture, to turn in bed, or to lift a burthen. The pain is sometimes excruciating, so that the patient is unwilling to repeat the motion; and, when the part is necessarily moved, as in respiration, coughing, &c., the suffering is very great. During the intervals of motion, there is generally also a sense of uneasiness or aching, with increased heat, and the part is usually more or less tender when pressed. Sometimes there is tumefaction; but it is seldom if ever considerable, and is often wanting. The pulse is sometimes excited, and the general heat increased; but the constitutional disturbance scarcely amounts to fever. Any of the external muscles may be affected, and the disease often takes a name according to its seat. The internal muscles are also often attacked either primarily or secondarily.

But this variety of rheumatism is not confined to the joints and muscles. It is probably capable of attacking any of the tissues. There is reason to believe that it sometimes seizes upon the nervous sheaths, producing pain upon pressure along their course, and extending an irritation to the nerves themselves, which is felt in pain and spasm of the parts to which they are distributed. Many of the severe and complicated nervous disorders both of external and internal parts, connected with tenderness of the spinal column when the spinous processes are pressed, are probably owing to subacute rheumatism in the sheath of the spinal marrow.

This variety of rheumatism is peculiarly liable to metastasis, certainly more so than either the acute or the chronic. In the acute, the inflammation is so severe as to give a strong direction of the disordered constitutional tendencies to its own seat; in the chronic, the disease appears often to be almost local, and indisposed to change. In the subacute, the constitutional tendency is strong, while the local affection is so feeble, that it readily yields to causes which give the irritation another direction. The variety is intermediate between the highly inflammatory and the pure nervous forms.

To complete a view of subacute rheumatism, it will be necessary to consider it in some of its more frequent and prominent seats.

In the Scalp.—The subcutaneous muscular and fibrous tissue of the scalp is occasionally attacked with this form of rheumatism. It is known by headache, often quite severe, soreness of the scalp on pressure, pain on the movement of the occipito-frontalis muscle, and the presence of rheumatism previously, or at the same time, in some other part of the body. These symptoms will in general suffice to distinguish it from nervous or sick headache, for which, without care, it may be readily mistaken. In this latter affection, pressure, instead of causing pain, often yields relief.

In the Eyes.—Rheumatism sometimes attacks the muscles of the eye, and sometimes its fibrous coat. In the former case, the motions of the ball are affected, and every movement which tends to put the diseased muscle on the stretch, or every attempt to contract it, occasions severe pain. When all the muscles are affected, the eye is held firmly in one position, from which it cannot move; but this is exceedingly rare. When the sclerotica is the seat of the disease, the ball is painful to pressure, and a dull redness may sometimes be seen through the conjunctiva; but it is often very difficult to distinguish the affection from ordinary inflammation, except by taking into consideration the constitutional tendencies of the patient, and the state of his system at the time.

In the Face.—The masseter muscle is sometimes affected with rheumatic inflammation, so that the patient cannot open his mouth, and great alarm is sometimes created under the apprehension of tetanus or locked jaw. It is sufficient for the physician to be aware of the occasional existence of such a condition of the muscle, to avoid all danger of so gross an error.

In the Neck.—Under the name of *stiff-neck, wry-neck,* or *torticollis,* rheumatism sometimes exists in the muscles of the side of the neck, especially in the sterno-mastoid. It may occupy both sides of the neck equally, in which case the head is held stiffly erect, and steadily looking forward; but much more frequently one side only is disordered, and the head is drawn towards that side, usually more or less obliquely. While the head is allowed to remain at rest, the patient is easy, or feels only a dull aching; but every movement is exquisitely painful.

In the Parietes of the Chest.—Pleurodynia.—This complaint is not unfrequent. It is a rheumatic affection of the intercostal muscles, and is characterized by severe, acute, and generally shifting pain in the side upon taking a full breath or coughing, by soreness of the intercostal spaces upon pressure, and by the general absence of fever. It resembles pleurisy considerably in its most obvious symptoms, and, when attended, as sometimes happens, by a slight febrile movement, or by an accidental cough, the diagnosis is so uncertain that it can be made out only by attending to the physical signs. (See *Pleurisy.*) The risk of confounding the two affections is increased by the fact, that, in consequence of the pain arising from contraction of the intercostals, there is little expansion of the affected side of the chest, so that the respiratory murmur is less distinct, and percussion somewhat duller than in health. As other muscles about the chest are often affected at the same time, the diagnosis is sometimes aided by the occurrence of severe pain upon attempting to twist or bend the trunk.

In the Abdominal Parietes.—This is a very rare seat of rheumatism, which nevertheless does sometimes attack the abdominal muscles, producing symptoms that might be mistaken for those of peritonitis, though distinguishable by the effect of movement, and the want of the constitutional symptoms of the former.

In the Lumbar Muscles.—Lumbago.—This occupies the muscles situated in the small of the back, sometimes extending up the spine, sometimes shooting round towards the abdomen. It may be upon one side exclusively, or upon both. It is often first recognized by the occurrence of a sharp pain, as if from the thrust of a knife, upon attempting to rise from the sitting posture, or to raise a burthen. When very severe, it confines the patient to bed, and in one position, from which he cannot move without exquisite suffering. In milder cases, the patient can often walk, but always stiffly, and generally partially bent forward upon the hips, with the spine perfectly rigid. It is not unfrequently attended with more or less febrile action, and may even be so severe and extensive as to come with great propriety under the division of acute rheumatism. In such a case, however, it usually forms a part of a more extensive affection. The effects of motion, and the tenderness on pressure, sufficiently distinguish it from the violent pains of malignant fevers. From inflammation of the kidneys it differs in wanting the peculiar direction of the pain towards the groin, the retraction of the testicles, the irritation of the urinary passages, and the nausea and vomiting which characterize that disease; as also in the more decided tenderness, and greater pain on certain motions which bring the muscles of the back into play. Disease of the spine occasions also severe lumbar pains, which are sometimes increased by motion; but there is less pain upon pressure, less acuteness in the symptoms, and more or less disorder in the functions of the lower extremities, which is wanting in lumbago.

In the Hip.—Sciatica.—The parts about the hip are often attacked with rheumatism, which is seated sometimes in the muscles, sometimes in the joint or in the ligaments of the pelvis, and occasionally also, there is reason to believe, in the neurilema of the sciatic nerve, showing itself by tenderness along the course of that nerve, and pain with other disordered sensations in the corresponding thigh and leg. The simultaneous occurrence, or previous existence of rheumatism in other parts, is the surest diagnostic sign of this affection, which might otherwise be readily confounded with neuralgic pains, or those having their origin in common inflammation. The steadiness of the pain, which is rather dull than acute, and its increase when the patient becomes warm in bed, are other signs of its rheumatic character. Sciatica, however, is more frequently chronic than either acute or subacute.

In the Heart.—The subacute form of rheumatism is peculiarly apt to invade the internal parts of the body. I believe that it is more frequently the origin of serious organic disease of the heart than the acute variety; at least, of the cases of chronic cardiac disease originating in rheumatism which have come under my notice, I am confident that the larger number have succeeded external attacks of rheumatism, too moderate or limited to be considered as belonging to the acute variety, as defined in this work. It is this form, too, which is most likely to seize upon the muscular structure of the heart, producing, according to its severity, immediate death, or severe pains, palpitations, oppression, &c., and not unfrequently terminating in a chronic affection with hypertrophy and dilatation of the organ. Cases of sudden death, leaving no satisfactory post-mortem evidences of their cause, are, I believe, occasionally attributable to the transfer to the heart, or the original occurrence in the heart, of a rheumatic irritation so severe as wholly to disable the organ, or the part of it affected, from contracting.

In the Alimentary Canal.—Instances of subacute rheumatism in the *œsophagus* sometimes occur, attended with a feeling of constriction, and severe pain in swallowing, but they are rare. In the *stomach* it is not uncommon, producing, according as it attacks the muscular or mucous coat, severe pain, with a sense of constriction, and great tenderness on pressure, or a sense of heat, weight, and oppression, with nausea and vomiting; and sometimes the two sets of symptoms are combined. Another not unfrequent seat of rheumatism, not sufficiently noticed, I think, by authors generally, is the *muscular coat of the bowels.* The patient complains of a constant aching in some portion of the bowel, especially of the ascending or descending colon, which is increased at times into the most violent pain, whenever the muscular coat is stimulated into contraction by the contents of the bowels, or by purgative medicine. Sometimes the muscle is so severely affected, that it ceases to be able to contract, and obstinate constipation ensues. There is generally tenderness on pressure, within a limited portion of the abdomen. The disease may often be recognized from occurring upon the retrocession of an external attack, or in individuals known to be subject to rheumatism. It differs from colic in being less decidedly spasmodic, and from ordinary inflammation of the whole thickness of the bowel, in the much less violence of the constitutional disturbance. Rheumatism sometimes also attacks the *mucous coat of the bowels,* producing diarrhœa or dysentery. Every practitioner, I presume, is familiar with instances, in which subacute external rheumatism has alternated with one of these affections. There is no reason, whatever, for considering the disease essentially different in its two seats.

In the Diaphragm.—Rheumatism sometimes attacks the diaphragm; and there is probably no seat in which it is more painful and distressing. A severe pain shoots from the epigastrium to the spine, sometimes through the body, sometimes circularly along the edge of the ribs, which, in violent cases, is increased to agony by every attempt to take a full inspiration. Breathing, which is performed chiefly by the ribs, is often very difficult and oppressed, and sometimes attended with feelings of suffocation. Hiccough, the sardonic laugh, and delirium, are said occasionally to attend the complaint. The swallowing of food produces acute pain at the point where the œsophagus penetrates the diaphragm, and sometimes the food is rejected in consequence of the spasm thus excited. In some instances, only a portion of the muscle is affected, and the pain may be confined to one side.

In the Liver and Kidney.—In both these glands, attacks simulating ordinary inflammation occasionally happen, in rheumatic individuals, either originally or by metastasis, which I have no hesitation in classing with the other forms of internal subacute rheumatism. When the liver is affected, there are pain and tenderness in the right hypochondrium, often a jaundiced hue of the skin and conjunctiva, and sometimes bilious vomiting, or melæna. In the nephritic affection, there is pain in the back, extending to the abdomen, and shooting towards the groin, and sometimes retraction of the testicle, but not, so far as I have observed, the copious deposition of urates which characterizes gout, nor so urgent a disposition to frequent micturition as in ordinary nephritis. The complaint, whether in the liver or kidney, is attended, as a general rule, with much less fever than ordinary inflammation of these organs, and very seldom ends unfavourably.

In relation to other organs little need be said. Neither the *brain nor its membranes* are often attacked with this form of rheumatism. There is reason to believe that the *pleura* sometimes becomes involved by its contiguity with the seat of the disease in pleurodynia; and it is not impossible that the inflammation may sometimes penetrate from the abdominal muscles to the *peritoneum*. The *uterus* is, I believe, frequently the seat of rheumatism; and it has appeared to me that some of the cases of dysmenorrhœa, which have come under my notice, were nothing more than examples of this affection.* Rheumatism also occasionally attacks the *ovaries* and *testicles*. It has even been noticed in the skin, either confined to one part, or attacking several parts successively, and exhibiting itself under the form of exquisite sensitiveness, so that the slightest friction produces severe pain, or as a steady aching or feeling of soreness, or a sharp pricking or darting pain of a neuralgic character, occurring at irregular intervals, and excited sometimes by the touch. (*Archives Gén.*, 3e sér., xii. 120.)

The duration of subacute rheumatism is exceedingly uncertain, and depends greatly upon the treatment. It is often relieved in two or three days, and sometimes runs on for weeks or months if neglected, degenerating, in the latter case, into the chronic form. Though much more readily subdued than the acute, it is much more liable to return quickly.

Causes.—The causes are the same as those of the acute variety. The complaint is very apt to result from a partial exposure to cold, as from small currents of cold air, or the uncovering, in a cold place, of a part of the body usually protected. It is said that sudden muscular movements, or violent straining, are apt to induce the disease. They may sometimes do so when a strong predisposition to it exists; but more frequently, when supposed to be the cause, they merely serve to make known to the patient the existence of the disease. When the constitutional tendency is very strong, it is probable that anything excitant may serve to bring on the local affection, such as stimulant drinks, or heating articles of food. Some individuals have a peculiar predisposition to this form of rheumatism.

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* For some supposed cases of rheumatism of the uterus, see a paper by Dr. J. E. Taylor, of New York, in the *Amer. Journ. of Med. Sciences* for July, 1845.

Diagnosis.—The suddenness of the attack, the severity of the local compared with the general symptoms, the sharpness of the pain upon movement when the muscles are contracted, the frequent mobility of the affection, and the entire absence of any tendency to suppuration, are characters by which muscular rheumatism [illegible] may be distinguished from common inflammation occupying the same parts.

Prognosis.—This is rarely otherwise than favourable. The disease is almost never fatal, unless when it seizes upon some vital organ, as the substance of the heart, and even then may very generally be relieved by appropriate remedies. The greatest danger is probably a sudden seizure of the muscular structure of the heart, so as to arrest its movements. Another danger is the production of chronic enlargement of that organ.

[illegible] *Chronic Rheumatism.*

This variety of rheumatism may exist in the fibrous, synovial, or muscular tissues, but is most frequent in the joints. It may occur either as an original affection, or as the consequence of an acute or subacute attack. It is sometimes limited to a single part, sometimes extends to several, and may be [illegible]. Generally speaking, however, it is more apt to be [illegible] when it is original than when [illegible] of the [illegible] varieties.

In [illegible] the swelling is generally not great, sometimes scarcely [illegible], unless the synovial membrane is affected, when there is [illegible] from the effused fluid. In old cases, however, the ligaments are often thickened, and there is [illegible] the [illegible]. Redness is generally [illegible] wanting. There is [illegible] more or less pain, which is dull and aching rather than acute, is often increased by the warmth of the bed at night, and is usually worse in damp, chilly weather. Rheumatic patients can [illegible] foretell a storm from the pains produced by the damp [illegible] which precedes it. In some instances, however, there is little pain, but only a feeling of stiffness and weakness [illegible]. The heat of the part is seldom increased. [illegible] the patient [illegible] chilly sensations, and these are sometimes the most unpleasant [illegible] of the disease.

When the muscles are affected, they often waste away, shrink, and become [illegible]; and when an opportunity has been offered of examining them after death, they have sometimes been found [illegible] with [illegible] in the cellular tissue [illegible] their fibres.

There is generally a complete absence of fever in chronic rheumatism, unless in some cases in which disorganization of the joints has taken place, with purulent secretion, [illegible] in consequence probably of [illegible] inflammation.

In [illegible] and very [illegible] cases there [illegible] they suffer [illegible] of the [illegible] arising from structural [illegible] and [illegible] of the [illegible], from contraction or shortening of the muscles and tendons, and sometimes from changes in the cartilages and bony structure, which [illegible] under the long-continued irritation. The joints are often distorted by the same causes, especially the joints of the hands, in which the fingers are bent to the side [illegible], and it has been observed that the [illegible] of the one hand [illegible] with that of the other in shape and direction. [illegible] of long standing, the muscles affected become [illegible] paralysed.

The disease may generally be relieved or cured, [illegible] apt to return. Sometimes it perseveres steadily in spite of remedies.

rendering the life of the patient miserable, and wearing him out at last by the incessant pains. In some instances, too, suppuration takes place in the joints, the synovial membrane ulcerates, the cartilages are absorbed, abscesses form in the soft parts and discharge externally; and the patient is at last worn out by hectic fever; or the denuded ends of the bone granulate and unite, forming complete anchylosis. But I have before mentioned my impression that, in these cases, common or scrofulous inflammation has been superinduced. It is highly probable that chronic diseases of the internal organs are occasionally of a rheumatic nature; and it is no unreasonable supposition, that changes in the structure of the heart are, in many instances, the result of chronic rheumatism of that organ.

The duration of chronic rheumatism is altogether irregular. It may continue for months, years, or a lifetime. Many persons affected with it have intervals of comparative comfort, recovering their health more or less completely during summer, to relapse again in winter, or varying with the condition of the weather, to the changes of which they become exceedingly sensitive, so as frequently to anticipate them before they are obvious to others.

The causes of this form of rheumatism are the same as of the acute; but the predisposition to it is not strongest in the same individuals. Age has great influence in this respect. The old are peculiarly liable to chronic rheumatism, though seldom attacked by the acute.

The complaints with which it may be confounded are common and scrofulous inflammation, and sometimes possibly paralysis of certain muscles. From the former it may be distinguished by its occurrence in individuals known to be rheumatic, its frequently shifting character, especially in the earlier stages, the absence of any tendency to suppuration, the sense of coldness which sometimes attends it, and its aggravation by wet damp weather, and by the warmth of the bed. A muscle may be deprived of the power of motion by rheumatism or by palsy, but the march of the disease is so different that, if proper investigation be made, there can be little difficulty in the diagnosis.

4. *Nervous Rheumatism.*

Rheumatism very often assumes the form of irritation, without the least sign of inflammatory action. It may be directed especially to the nervous system, evincing itself by pain, or other disordered sensation, and by irregularities of the motive power; or it may affect any other portion of the body, or any one of the organs, producing derangement of function in the part or organ affected. The question may perhaps be asked, how it can, under these circumstances, be known to be rheumatism? The answer simply is, that these irritations often alternate with, supersede, or are superseded by inflammatory attacks of rheumatism, without the operation of any discoverable additional cause. A patient will be attacked with a neuralgic pain in the face, dyspeptic sensations in the stomach, or colicky pains in the bowels, which will instantly cease upon the occurrence of an attack of subacute rheumatism in one of the joints or muscles, and return upon the retrocession of the latter affection. It is scarcely possible to resist the conclusion, that the same peculiar state of system, the same predisposition or diathesis, lies at the foundation of both these modes of derangement, which are, in fact, nothing more than signs of the real disease, the essence of which escapes our notice.

But the particular disorders of sensation and function, which fall under this head, are so precisely like those of a similar variety of gout, that it would be useless repetition to treat of them particularly in this place; and I shall content myself with referring the reader to the subject of *nervous gout.* In fact, the only mode of deciding, in relation to any one of these disorders, whether it belongs to rheumatism or to gout, is to notice with which of these diseases, in their inflammatory forms, it is apt to be associated or to alternate; and, if no such association or alternation exist in the case, which is a very rare circumstance, then to ascertain what are the hereditary tendencies of the individual. Yet, that there is some real difference, though it may altogether escape our powers of observation, is proved by the fact, that, when the irritation is connected with inflammation, the latter almost always assumes the same form in the same individual, whether that form be gout or rheumatism. There is one form of nervous disorder supposed to be not unfrequently of rheumatic origin, which does not equally occur in gout, probably in consequence of the age at which it generally makes its attack; I allude to chorea.

To give a very general idea of these derangements, it is sufficient here to state that rheumatic irritation may assume the form of neuralgic pains in any part of the body; of vertigo, dizziness, headache, tinnitus aurium, perverted vision, &c., when it affects the brain; of hurried or irregular breathing, and even violent dyspnœa, in the respiratory apparatus; of palpitations, oppression, and precordial distress, in the heart; of dyspeptic sensations, nausea or vomiting, spasm, &c., in the stomach; of colicky pains in the bowels; and of painful sensation, and perverted function in the liver, kidneys, and genitals.

The exciting causes of this variety of rheumatism are the same as of the others; but there is a different condition of system in the individuals subject to it, which determines this rather than the inflammatory forms. A predominance of the nervous temperament, sedentary habits, abstemious modes of living, and, generally, whatever tends to depress the powers of the system at large, may be considered as favouring the production of nervous rheumatism. Hence, it is most frequent in females, students, and professional men, especially those of temperate lives.

Though a painful, sometimes alarming, and in many instances a most harassing disease, it is not often really dangerous; and persons subject to it often live to an advanced age, and occasionally, after passing the prime of life, find the tendency to it to diminish or cease altogether. It is true that it sometimes seizes upon the heart, brain, lungs, or stomach with a fatal violence; but these cases are rare; and, when death occurs in the course of the disease, it is much more frequently from the supervention of some organic affection, than from the simple uncomplicated irritation.

Nature of Rheumatism.

Having taken a view of the different forms of rheumatism, we are now prepared to consider its nature. The opinion was at one time prevalent, that this disease was dependent on a peculiar offending matter pervading the system; and, even at the present time, not a few pathologists are disposed to ascribe its peculiarities to the abnormal presence of an acid in the circulation, which, according to Dr. Prout, is the lactic, according to others, the uric acid. But there is so utter a want of proof as to the uniform existence of any such offending cause in rheumatism, that, in the present state of our knowledge, the opinion must be looked on as purely speculative.[*]

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[*] Dr. Garrod found in the blood, in acute rheumatism, only that proportion of uric acid which exists in health; but Dr. Maclagan, of Edinburgh, in a few cases which he examined, discovered an excess both of uric acid and urea, and is disposed to believe that such an excess is general. (*Ed. Month. Journ. of Med. Sci.*, N. S., v. 21.) But before this humoral opinion of the nature of rheumatism can be admitted as established, it is necessary to demonstrate not only the presence of the offending matter in so large a number of instances as to leave no room for reasonable doubt that it is universal in this disease, but also its absence in other febrile and inflammatory affections. Now

Another notion is, that the disease is nothing more than ordinary inflammation, owing any peculiarities which it may exhibit to the tissue in which it is seated. But the truth is, that the disease is not necessarily inflammatory. It is often purely nervous, and no explanation of its nature is admissible, which does not take this fact into consideration. Besides, ordinary inflammation, occupying precisely the same parts, presents different phenomena.

All that we know of the real nature of the disease is, that it is peculiar, and that it owes this peculiarity, not to the character of the cause, but to some unexplained condition of the system, called the rheumatic predisposition or diathesis. I am inclined to the opinion, that this diathesis is in itself a morbid state, in fact, the true disease, and that the irritation and inflammation by which it is recognized, are merely symptoms of its full developement. That the rheumatic differs essentially from ordinary inflammation, is shown chiefly by its shifting character, its disposition to alternate with mere irritation or functional disorder, and the almost entire absence of any tendency to suppuration, even in the most violent cases.

Treatment of Rheumatism.

1. Of Acute Rheumatism.—When the pulse is full and tense, and the inflammation severe, bleeding should be employed with a freedom proportionate to the vigour of the patient's constitution, and to the resistance of the pulse. It is never proper to bleed for the pain alone. This is often extremely severe, where there is comparatively little activity of inflammation, or vigour of circulation. The pulse, and the obvious amount of local disease, as exhibited by the heat, swelling, tension, and redness, are much surer guides than the degree of pain. The loss of blood is generally borne well; and the operation may often be repeated once and again, if called for by the symptoms. The quantity to be taken at each time must vary with the effects produced upon the circulation. The orifice should be closed as soon as the pulse begins to flag; and syncope, or an approach to it, should never be aimed at. Generally, from twelve to twenty-four ounces may be taken from a robust individual, with a strong pulse. One or two full bleedings are generally sufficient; and, when the pulse begins to become more frequent, with diminished strength, the remedy should no longer be employed.

It should be remembered that bleeding alone often fails to cure the disease. Carried to great excess, it may cause such a collapse of the vessels that they cannot support the inflammatory process; but the disease does not necessarily cease, under such circumstances, with the subsidence of the inflammation. The morbid tendency may still exist, and, though it may not be able to raise the vascular actions to inflammation, is still competent to the production of irritation even of a violent character. No longer attracted externally by the local disease, it may fix upon one of the internal and vital organs, with even fatal intensity. Sudden death has resulted from an apparent transfer of rheumatic irritation from the exterior to the heart, after copious depletion. The remedy must, therefore, be used with caution; and, though there are many cases in which it may be employed freely, there are many others in which it is of doubtful propriety, and some in which it is altogether forbidden. In feeble and anemic individuals, it should not be employed unless in obedience to some urgent necessity.

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acid in the breath, perspiration, and urine is so common in complaints having none of the characteristics of rheumatism, that even if it should be shown to be always present in this affection, which it has not been, we should be justified simply in considering it as a result of morbid processes common to rheumatism and other diseases, and not as the essential characteristic and essence of the former. (*Note to the fourth edition.*)

Purging is probably not less efficacious than venesection. Nature occasionally points out this remedy by curing an external attack, through the supervention of diarrhœa. The purgation should be active, but not drastic. Senna with sulphate of magnesia, jalap and bitartrate of potassa, and, when there is torpor or congestion of the liver, calomel, alone or in combination, are generally suitable articles to begin with. The purgation should be repeated every other day; but, after the first or second occasion, it will usually be sufficient to employ sulphate of magnesia alone, or combined with magnesia and wine of colchicum, as recommended by Scudamore. This mixture is well adapted to cases originally mild, or in which the excitement has been reduced by depletion.[*] Should the bowels become irritable, the purgation should be suspended. An objection to purging is the difficulty of changing position; but this may generally be obviated by the use of the bed-pan.

The refrigerant diaphoretics are well adapted to the earliest and most inflammatory stage of the disease. Tartar-emetic and nitre form an excellent combination. From one-twelfth to one-sixth of a grain of the former, and from five to ten grains of the latter, may be given dissolved in water, at intervals of one, two, or three hours. Citrate of potassa, in the form of neutral mixture or effervescing draught, may be used, if the former combination offend the stomach. These remedies may be aided by the occasional use of the warm bath, if not too inconvenient on account of the difficulty of moving the patient. The object, in the use of the diaphoretics above mentioned, is not so much to induce perspiration, as to sustain a moderate sedative impression upon the circulation. The old plan of heaping bed-clothes upon the patient, and forcing copious sweat by draughts of hot water or herb teas, has been abandoned as generally useless, if not injurious.

Very soon after the commencement of the disease, the bowels having been thoroughly evacuated, and blood, if deemed advisable, taken from the arm, opium and ipecacuanha should be given at bed-time, to allay the violence of the pain, and procure sleep. A grain of each, repeated, if necessary, at the end of two hours, and increased somewhat as the system becomes accustomed to it, will generally be sufficient. The ipecacuanha is advisable to correct the stimulant tendency of the opium. After a few days, when excitement has been considerably subdued by depletion, this combination may be given steadily, at certain intervals, through the day and night, so as to keep the system always under its influence. Ten grains of Dover's powder may be given every four, six, or eight hours, according to the susceptibility of the patient to the opiate influence. Sometimes it will be sufficient to give half the quantity. Should it be doubtful whether excitement has been sufficiently reduced for the remedy, as just recommended, the proportion of ipecacuanha may be doubled, unless found to nauseate the patient.

When the pulse has lost its tension, and especially if it be rather feeble, advantage will accrue from combining powdered guaiac with the Dover's powder. The guaiac is supposed to exercise an alterative influence over the disease. From ten to twenty grains of it may be given with each dose.[†]

Should these remedies have failed to make the desired impression at the end of one or at furthest two weeks, or should the disease assume in any respect a threatening character, it will be advisable to employ calomel with a view to its alterative influence. Advantage will often accrue from its use at an earlier period, with the opium and ipecacuanha, in the dose of two grains at bed-time. This quantity will sometimes of itself exercise a favourable influence, without positive salivation, while it prepares the way for the more ready production of a decided mercurial impression, should this become desirable. I have no doubt whatever of the frequently controlling influence of mercury over acute rheumatism, at this stage. If employed early, before the requisite reduction of the general excitement, it may fail to remove the disease, while it adds to the other inconveniences that of a sore mouth, and to the existing excitement the additional one produced by the mercury. Should the case be in a somewhat advanced state when it first comes under the notice of the practitioner, the calomel and opium treatment may be commenced immediately. There is generally a speedy abatement of the symptoms on the occurrence of soreness of the gums. It is seldom desirable to induce a copious salivation; and I always suspend the mercurial at the first decided indications of its action upon the mouth.

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[*] The following formula may be used. ℞.—Magnesiæ Sulphat. ℥ss; Magnesiæ ʒss; Vin. Colch. Rad. fʒss; Aquæ fluv., vel Aq. Acid. Carbonic. q. s. Fiat haustus.

[†] The following is a convenient formula. ℞.—Opii pulv., Ipecac. pulv., āā gr. vj; Potassæ Nitrat. ʒj: Guaiaci Resinæ pulv. ℥iss. Misce, et divid. in chart. no. vj. S. One to be taken in syrup or mucilage, every four, six, or eight hours.

It is at the same stage that colchicum proves most effectual. This may sometimes be tried advantageously before the mercurial, or may be given in aid of it. It is usually best combined with one of the salts of morphia; and this combination may be substituted for the Dover's powder; twenty or thirty drops of the wine of colchicum root, and a fluidrachm and a half of the solution of sulphate of morphia, equivalent to about a grain of opium, being given every four, six, or eight hours.

Occasionally an adynamic condition of system comes on in the course of the complaint, attended with very copious sweating during sleep, and sometimes considerable nervous disturbance. Under these circumstances, I have been long in the habit of using sulphate of quinia, and have scarcely ever known it to fail, not only in obviating the debility, but also in greatly relieving if not curing the disease. A grain may be given every hour. More than this will seldom be required. It must be particularly remarked that one of the conditions is the occurrence of copious sweats during sleep. This occasionally happens without the least alleviation of the pains, swelling, &c., and is probably the mere result of debility, with some irritation of the circulation. When there is considerable prostration, it may become desirable to administer carbonate of ammonia; and the ammoniated tincture of guaiac may now also be used with hope of benefit, in the dose of a fluidrachm every four hours, or less frequently.

Should the heart or the brain become seriously involved, in the course of the disease, depletion by the lancet must be carried as far as it can be borne; leeches or cups must then be used freely; and these must be followed quickly by a large blister. In the cardiac affection, the cups may be applied between the shoulders, and a blister eight inches by ten over the region of the heart; in the cerebral, the head should be shaved, leeches or cups applied to the scalp and temples, and afterwards, should the symptoms continue alarming, a blister over the whole head. Along with these means, calomel should be given promptly and freely, so as to induce ptyalism. Efforts should be made, in case of retrocession of the external disease, to invite it back to its original seat by sinapisms, or other active rubefacient, or by blisters, and, should the feet have been the part affected, by hot stimulating pediluvia.

The same plan of treatment, in greater moderation, would be applicable to any other internal inflammation supervening upon acute rheumatism.

In the form of the disease which occurs in miasmatic regions, and which has been already described under the name of bilious rheumatism, calomel should be given as a cathartic in the early stage, and recourse be had to quinia as soon as an intermission, or a decided remission shall have been obtained.

The *local measures* applicable to acute rheumatism have not yet been mentioned. I believe that, upon the whole, the less that is done in this way the better. Should the disease be confined to one part, advantage might result from leeches; but to follow it up by this remedy, in its course over the body, would be futile. Should the spinal column be found tender, with rheumatism in the lower section of the body, cups should be applied to the tender part. Perhaps the best plan, as a general rule, is to keep the affected part enveloped in soft flannel, lambs'-wool, or carded cotton; but these applications should not be persevered in if uncomfortable to the patient. Sometimes, when the pain is excessive, emollient cataplasms with the addition of laudanum or other narcotic will afford relief. Dr. M. B. Smith, of Philadelphia, has spoken highly to the author of the efficiency of the tobacco cataplasm. Towards the decline of the complaint, when the parts are still somewhat swollen and painful, but the fever has subsided, anodyne and rubefacient lotions are sometimes useful, such as camphor liniment, the camphorated tincture of soap with laudanum, and the same preparation with the addition of spirit of ammonia. At a still more advanced period, when the disease may seem peculiarly adhesive in one or a few parts, and threaten to become chronic, repeated blisters are the most efficient remedies; and, if the rheumatic pains are severe, acetate of morphia in powder may be sprinkled upon the blistered surface, denuded of the cuticle. Cold water, as an application to the inflammation of acute rheumatism, has been recommended; and it will no doubt often remove the local affection; but there would always be great hazard of serious internal disease. Flannel bandages, as recommended by Dr. Balfour, may be occasionally used with advantage, when the case threatens to assume the chronic form; but they are wholly inapplicable to the acute condition. They have been known to occasion a retrocession of the inflammation, and the supervention of severe cardiac disease. The hot bath comes in very usefully, in some cases, after the subsidence of fever and acute inflammation, when the surface is pale and inactive, and the local disease adhesive. It may be used daily.

The above is the plan which I have usually employed in the treatment of acute rheumatism, and with results, upon the whole, so satisfactory as to indispose me to any experimental measures. It is, nevertheless, proper to allude to other modes of treatment, which have received more or less attention from the profession, and have been sanctioned by authoritative names.

M. Bouillaud relies chiefly on large daily bleedings, with the free applications of cups or leeches in the intervals. From robust patients, during the first four or five days, he takes by these methods an average quantity of four or five pounds; in very severe cases, as much as six, seven, or eight pounds; in mild cases only two or three pounds. Under this plan, the medium duration of rheumatism in his hands is only one or two weeks, instead of six or eight; and, up to the publication of his treatise, there had been no death, even in cases complicated with disease of the heart. Other practitioners have not met with the same success from this plan; while the records of medicine are not without cases of fatal results, attributed to excessive depletion.

Dr. Hope, along with moderate depletion, recommended the early and vigorous use of calomel and opium, alternated with active purgation. The plan, which he adopted from Dr. Chambers, was, after full bleeding in the robust, but without that measure in the weak, to give eight or ten grains of calomel, with a grain and a half of opium, every night, followed in the morning, by the infusion of senna with salts, sufficient to procure at least four or five stools. At the same time, a saline draught with fifteen or twenty minims of wine of colchicum, and five grains of Dover's powder, was administered three times a day. The calomel was omitted when the swelling and pain greatly abated, or the gums became in the least tender. According to Dr. Hope, the patients generally recovered under this plan in a week.

The use of Peruvian bark in rheumatism is a very old practice. A few years since the plan of giving enormous quantities of sulphate of quinia, in the acute form of the disease, was proposed by M. Briquet, of Paris, and carried into effect with the most surprising results; the disease being almost as promptly cured as intermittent fever by the same remedy. From a drachm to a drachm and a half was given daily, in divided portions. As might have been anticipated, though the external inflammation was suppressed by the powerful influence of the remedy on the brain, yet that organ often became violently affected, and sometimes with fatal results. I consider the practice, at this risk, altogether unjustifiable. Sulphate of quinia is often, however, of great benefit in acute rheumatism, moderately administered; and I have already pointed out the circumstances under which it has appeared to me most effective.

MM. Gendrin and Solon revived, in 1833, a plan which had been long before proposed and abandoned, of treating the disease with large doses of nitre dissolved in large quantities of water. The mean quantity of the salt given daily was an ounce, dissolved in three quarts of water; and the average length of treatment was eight days. The practice is likely to fall again into neglect. The risk of injury to the stomach from the large amount, as well of the liquid as of the salt, will probably always be an insuperable objection to the general adoption of this plan. The same quantity of nitre, with a small quantity of water, would endanger poisonous effects. Dr. Golding Bird has employed the acetate of potassa, and considers it preferable to the nitrate. (*Lond. Lancet*, Feb. 15, 1851, p. 177.)

Among the other heroic plans of treatment is that of large doses of opium, as employed by Dr. Corrigan, of Dublin, who gave, on the average, ten or twelve grains of the narcotic daily, and in some instances more than double the amount. Full doses were given at first, and increased until decided relief was obtained, after which the medicine was continued in the same amount, until the disease had declined. The average duration of the treatment was nine days; and no evil effects were experienced. It might, however, be very dangerous, should a tendency exist to cerebral disease.

Still another of the heroic plans is the use of tartar emetic, in the quantity of twelve grains or more through the day, according to the contra-stimulant method. The danger from this plan, independently of the possible prostration, would be the excitement of an irritation in the stomach, which might render it the focus of the rheumatic disease. The same objection lies against the repeated use of emetics.

Phosphate of ammonia has been strongly recommended in rheumatism by Dr. T. H. Buckler, of Baltimore, under the impression that it tends to eliminate uric acid from the system, by forming with it a soluble urate of ammonia; the phosphoric acid being neutralized by the soda with which the uric acid may be combined in the blood. The salt is recommended in doses varying from ten to twenty grains, and given from three to six times in the twenty-four hours. It may be employed in all the different forms of rheumatism. (*Am. J. of Med. Sci.*, N. S., xi. 108.) Dr. Samuel Edwards, of Bath, England, has published statements strongly confirmatory of those made by Dr. Buckler. (*Prov. Med. and Surg. Journ.*, Nov. 17, 1847.)

Alkaline remedies have been employed in the cure of rheumatism, on the ground of the essential acidity of the system in that complaint. Dr. S. Wright, of Birmingham, England, has for years depended chiefly on these remedies, and found them extraordinarily effectual. He prefers soda to the other alkalies, giving the bicarbonate internally, and applying the carbonate externally in baths. (*Med. Times*, June 5, 1847.) Others prefer potassa; and the officinal solution, or liquor potassæ, is sometimes employed. Besides the correction of acidity, another effect expected from the alkalies is to render the fibrin more soluble in the blood, and thus to prevent or correct the fibrinous deposits in the heart, which sometimes so seriously complicate the disease.

A directly opposite plan has recently been proposed by Dr. Owen Rees, of London, who has found lemon-juice, in the dose of one or two fluidounces from four to six times a day, very efficient in acute rheumatism, rapidly reducing the pulse and relieving the pains, and effecting the cures in a shorter average period than the plans ordinarily followed. It is only the sthenic cases to which the remedy is applicable. The method has been followed by other practitioners with similar results. Dr. Wm. Pepper, of Philadelphia, has reported a number of cases, successfully treated by him with this remedy in the Pennsylvania Hospital. Great relief was generally obtained in about a week, and in some in a shorter time, and most of the patients were discharged cured in less than two weeks. (*Trans. of Col. of Phys. of Philadelphia*, N. S., i. 124.) Dr. Babington, of London, has found the juice very successful, and believes that no other remedy is equally efficient. But he employs it in larger doses than above mentioned, giving as much as six ounces three times a day. (*Lancet*, Nov. 8, 1851, p. 431.) Others have not been equally successful; but it must be recollected that it is only in acute rheumatism that much is expected from it. In two cases in the Pennsylvania Hospital, both acute, and closely resembling each other, I employed in one the lemon-juice, and in the other the plan of treatment recommended in this work. At the end of about a week the latter was convalescing, and no apparent effect had been produced in the former. I then abandoned the lemon-juice, and adopted the same treatment as in the other case, under which the patient speedily recovered. This is the amount of my experience with the remedy.

Dr. Ruschenberger, of the U. S. Navy, has found great advantage from cold water dressings to the joints, and the use of from three to six grains of opium at night, with an equal quantity of sulphate of quinia. (*Am. Journ. of Med. Sci.*, N. S., xiv. 263.) Dr. John Hastings has employed pyro-acetic spirit both in acute and chronic rheumatism, and in gout, "with a success quite extraordinary." (*Lancet*, Jan. 16, 1847.) Iodide of potassium, sulphur, and aconite, which have been lauded in acute rheumatism, are better adapted to the other varieties. The leaves of the common European ash, in substance or infusion, have been recently recommended on the continent of Europe. (See *Lond. Med. Times and Gaz.*, v. 650.)

MM. Piedaguel and Trousseau cure acute rheumatism generally in seven or eight days by veratria, in the dose of about one-thirteenth of a grain; one dose being given on the first day, two on the second, three on the third, and thus with a like increase up to the sixth or seventh, if the symptoms do not previously abate. When this happens, the number of doses arrived at is continued for two or three days, then diminished daily with the decrease of the disease. (See *Am. J. of Med. Sci.*, N. S., xxvi. 496.) American hellebore has been employed in this country. (See *U. S. Dispensatory*.)

Great success has been claimed for an expectant plan, pursued by M. Gouzée in the military hospital at Antwerp. A comfortable and uniform temperature, pure air, the free use of diluent drinks, prolonged local tepid baths once or twice daily, cataplasms in the intervals, confinement to bed for a few days during convalescence, and the use of simple bitters or quinia at this period, constitute the sum of the treatment. The disease naturally, it is stated, tends to recovery in a week or two, and the patient gets well as speedily as when actively treated, if not more so. (*Ranking's Abstract*, xviii. 234.)

2. OF SUBACUTE RHEUMATISM.—In this variety, venesection is seldom requisite; though, when the patient is robust, and the pulse tolerably strong, a moderate bleeding will occasionally hasten the cure. Purging is highly useful. A full dose of sulphate of magnesia, or of this with infusion of senna, followed, every other day, with the mixture of magnesia, Epsom salt, and wine of colchicum root, already referred to, may be given in ordinary cases. Should the patient be too much weakened to permit a continuance of this course, his bowels may be kept open by sulphur, or a mixture of sulphur with magnesia, or with bitartrate of potassa. After the bowels have been once thoroughly evacuated, opium and ipecacuanha may be prescribed, either in the form of pill, or that of Dover's powder. This is often very effectual in subacute rheumatism, putting an almost immediate end to the complaint. A large dose of the opiate may be given at bed-time, and smaller doses regularly at intervals of four, six, or eight hours. Colchicum also displays very strong powers in this variety of the disease. It may be given alone, in doses of twenty drops of the wine of the root, or a grain of the acetic extract, repeated every four hours, and diminished or increased according to its effects. It is always desirable to procure from it some influence upon the skin, kidneys, or bowels; but to suspend it, or diminish the dose, when the stomach is nauseated. It may often be advantageously combined with the solution of sulphate of morphia, so as to keep the patient under a moderate narcotic impression; or the acetic extract may be combined in pill with the ipecacuanha and opium, in cases in which the stomach is not easily nauseated.

Should the patient have a sour breath, or sour exhalations from the body, or should his urine exhibit an excess of uric acid, the alkaline remedies may be added, especially bicarbonate of potassa or of soda.

The warm or hot bath is often very useful in this variety of the disease, and may be associated, with great propriety, in somewhat obstinate cases, with the Dover's powder, or colchicum. The hot bath is preferable when the actions of the system are feeble, and the skin pale and bloodless.

Aconite, belladonna, stramonium, and conium, severally, or variously combined, may be resorted to in obstinate cases; and sometimes act very promptly and efficiently in the cure. Somewhat similar, probably, in their action, are the decoctions of dulcamara and cimicifuga, which have been recommended. In debilitated cases, the ammoniated tincture of guaiac is an excellent remedy.

Mercury would no doubt be as efficient in this as in the other varieties of rheumatism; but it is only in cases verging towards the chronic form, and threatening, if not arrested, to be of lasting inconvenience, that its employment would be justifiable.

Local Treatment.—When the inflammation is considerable and fixed, as in lumbago and pleurodynia, cups or leeches are often very useful, and may be freely applied. They are, however, comparatively seldom required; as the disease, in the great majority of cases, yields in a few days without them. When the affection can be traced to the spinal column, the blood should be taken, not from the seat of the pain, but the immediate vicinity of the tender spot in the spine; and the same remark is applicable to the subsequent use of rubefaction, blistering, or pustulation, should either of these methods of revulsion be deemed advisable.

In relation, however, to the appropriateness of local irritant remedies in this variety of rheumatism, though they are often very efficient in unseating the disease, yet I have long entertained some doubt. This is a peculiarly changeable form of rheumatism, and dangerous metastasis to internal parts sometimes takes place. When a young practitioner, I witnessed fatal results, in an attack of lumbago, from the transfer of the irritation from the back to the interior organs of the chest, consequent upon the application of a blister to the lumbar region. The apprehension of similar results has since deterred me from the frequent use of repellent remedies, in cases of external subacute rheumatism. My practice has generally been to keep the part covered with flannel, carded wool, or cotton, or to leave it protected only by the ordinary clothing, of which a part, in this and all other kinds of rheumatism, should be flannel next the skin. But many practitioners freely use and recommend local irritant applications; such as Cayenne pepper with hot spirit, oil of turpentine, solution of ammonia, sinapisms, and blisters. Anodyne applications are also frequently employed, as camphor liniment, camphorated soap liniment or tincture with or without laudanum, chloroform, plasters made with the extract of belladonna, or of aconite, &c. Ointment of iodide of potassium has been used with asserted benefit. Cyanuret of potassium has been employed, either in solution in the proportion of one part to seventy-five parts of water, or in the form of ointment made with three grains of the cyanuret and an ounce of lard; the remedy being applied three times a day. (*Valleix.*) Cold water has been recommended; but this I should consider very hazardous. It is in this form of rheumatism, and in the neuralgic, that acupuncturation has been most efficient. In some cases, as in stiff neck, heat may be advantageously employed, by placing a batch of carded tow or cotton over the part, and then applying a hot flat-iron.

Internal rheumatism, belonging to this variety, must be treated upon the same principles as ordinary inflammation of the same organs, though it will seldom be necessary to push depletion to an equal extent. General or local bleeding or both, purging, blistering, the ordinary methods of recalling disease to the external parts, and, if these fail, the use of mercury, are the chief remedial measures. The combination of opium, calomel, and ipecacuanha often answers an excellent purpose. Sometimes, after due depletion, the disease gives way to the use of colchicum or aconite, when it has resisted other means; and all the general remedies, found useful in external rheumatism, may be employed in obstinate cases.

Individuals who are very liable to this form of rheumatism, will find great advantage in watching its first approaches, and averting it by means of a full dose of one of the salts of morphia with wine of colchicum, at bedtime. Should this combination produce constipation, the addition of half an ounce of one of the neutral salts will obviate the result. Great watchfulness, however, will be necessary to avoid the contracting of a habit of using the narcotic as a luxury rather than as a medicine.

3. OF CHRONIC RHEUMATISM.—An immense variety of remedies has been employed in this complaint, many of which are probably quite useless, and owe their reputation to their introduction at one of those frequent conjunctures, when nature is on the point of effecting a temporary cure. Of all the means which I have employed, none has seemed to me so effectual in obstinate cases as mercury. It will, I am very certain, cure the disease, at least for a time, in the great majority of instances. I have repeatedly commenced my rounds in the Pennsylvania Hospital, with numbers of old rheumatic cases in the wards, and have been able to clear them out effectually by the use of this remedy. By the late Dr. Otto, of Philadelphia, the attention of the medical public, in this country, was first strongly called to this application of mercury. (See *Eclectic Repertory*, ix. 528.) The disease will often give way

to a moderate use of the remedy; but, when of long standing, it may require a perseverance for two or three weeks of decided ptyalism, to effect a cure. The remedy, however, is so inconvenient and disagreeable in its action, that efforts should always be made to relieve the patient by other means; at least, the mercurial plan should not be hastily and recklessly resorted to in ordinary cases. The following remedies and plans of treatment appear to me to merit attention, the general being first mentioned, and afterwards the local.

General bleeding is seldom required, or, indeed, admissible in chronic rheumatism; though sometimes, when the complaint approaches to the subacute form, and the patient is robust, a moderate quantity of blood may be taken from the arm with advantage.

Purging is often of great use. The character of the cathartic employed should vary with the degree of activity in the local affection, and with the strength of the patient. When the disease is fixed in one of the large joints, and there is no apprehension from debility, a dose of jalap and cream of tartar or of senna and salts, may be given twice a week, for a long time. When something milder is required, Scudamore's mixture, or one of the neutral salts alone may be used, as in the former varieties. Sulphur is also frequently useful as a laxative.

During the continuance of the purgative plan, the patient, if he suffer much from pain, may take the Dover's powder every night; and, if this be preceded by the hot bath, the curative effect will often be very decided.

At the same time, he may employ, during the day, some one, or some combination of those numerous medicines which have proved useful in rheumatism by a supposed alterative action. As the precise mode in which these remedies do good is not known, they need not be employed with any great discrimination. Those which the experience of the practitioner may suggest as likely to be most effective may be first tried, and others resorted to successively as the exigencies of the case may require. Attention, however, should always be paid to the existing grade of excitement, and the remedies should be selected accordingly; those of a debilitating character being avoided when the patient is weak, and the stimulating when the condition of the system is decidedly sthenic.

Of these alteratives, *colchicum* is one of the most efficient, and may be given three or four times a day, in doses within the nauseating or purging point. This remedy has appeared to me most beneficial in those cases in which the local affection is migratory, and approaches the neuralgic form. *Iodide of potassium* is often very useful. I have found it most effectual in cases in which there was reason to suspect a syphilitic origin. In some of these it has operated like a charm, relieving, in the course of a few days, rheumatic pains which have lasted for months. It may be resorted to in all cases of vague pains in different parts of the body, with little or no swelling, particularly when there is reason to suppose that they are seated in the periosteum or the bones; and in cases of this kind it often operates admirably well, even when there can be no suspicion of syphilitic taint. It may be given in the dose of from five to twenty grains, three or four times a day; but its operation should be carefully watched, and the medicine omitted, or moderated, if it irritate the stomach, or produce any other unpleasant effect. *Nitrate of potassa* has been used in chronic as well as in acute rheumatism. Of 100 cases treated by Dr. John Carghill with nitre, 61 were cured in an average period of about 14 days; while of 43 treated with colchicum, only 14 were cured after a treatment of about 15 days. He gave from two scruples to two drachms in barley water three times a day. (*Lond. Med. Gaz.*, xiii. 639.) Dr. Fuller, in his treatise on rheumatism (*page* 29, Am. ed.), speaks of mu-

riate of ammonia as a remedy "of singular efficacy." *Sulphur*, besides being useful as a laxative, is an excellent alterative in chronic rheumatism, well adapted to mild cases, and sometimes of itself adequate to the cure. *Guaiac* has long enjoyed a high reputation in this disease. In the chronic variety, it is most frequently used in the form of simple or ammoniated tincture; but its stimulating properties should always be borne in mind. The other alterative diaphoretics are occasionally employed, most frequently in the form of *compound decoction* or *compound syrup of sarsaparilla*, which is frequently associated with a mercurial course. *Turpentine*, or *its volatile oil*, and *copaiba*, are occasionally used with advantage, and are especially recommended in chronic lumbago and sciatica. Dr. Chapman speaks in strong terms of the efficacy of *savine*, which he introduced into the treatment of this disease. Some have found great advantage from *capsicum* very freely used. *Arsenic* has occasionally proved very efficacious, and is thought to be specially useful in cases in which the periosteum is affected. Other remedies which merit notice are *cimicifuga*, the berries and root of *phytolacca decandra* or the common poke, and *xanthoxylum* or prickly ash, for the mode of using which the reader is referred to the dispensatories. *Cod-liver oil* is very highly praised by the German practitioners. It is particularly applicable to cases in which the rheumatism is complicated with a scrofulous taint. I have seen obstinate cases of what was originally supposed to be rheumatism of the knee or of the ankle, with an anemic state of the circulation, a frequent pulse, and tendency to night-sweats, get well under perfect rest of the joint, and the use of cod-liver oil, after the ordinary anti-rheumatic remedies had been exhausted without effect. *Purging flax* has recently been brought into notice, or rather its old reputation has been revived, by Dr. Butterlane, as a remedy in chronic rheumatism. He gives it in extract or infusion, and in such doses as to purge moderately, and act as a diuretic. (*Med. Times*, July, 1850.)

Various narcotics are much and usefully employed, especially when the disease is very painful, and somewhat neuralgic. The extracts or tinctures of belladonna, stramonium, conium, and aconite, are especially worthy of notice. They are usually given in connexion with some one or more of the other remedies mentioned.

Various kinds of bathing are among the most efficacious methods of cure. The *hot bath* taken daily, and persevered in for a considerable time, often does much good; and obstinate local affections sometimes give way to a stream of hot water directed upon them, or the hot douche. A visit to the hot springs in Virginia may be recommended. *Sulphur baths* have also proved very useful, conjoined with the drinking of sulphurous waters. To obtain the advantages of this remedy, the patient may resort to some one of the sulphur springs among the mountains of Virginia, to the Blue Lick springs of Kentucky, or to the springs of Avon and Sharon in New York. *Sea bathing* is sometimes beneficial; and I have no doubt that the plans of the hydropathists often break up obstinate cases of this complaint, by thoroughly changing the condition of the system. Care should be taken, whenever cold bathing is employed, that reaction should subsequently take place, and be sustained by friction and exercise. *Vapour baths* are also among the vaunted remedies for chronic rheumatism, and no doubt often prove efficacious. Very obstinate cases have yielded to the *vapours of sulphur*, and those of *camphor* are asserted to have been successfully employed. These vapours are applied by means of a wooden box, in which the body of the patient is confined, while his head projects. Baths of the *vapour of turpentine*, at a temperature of from 140° to near 160° Fahr., have been found safe and effectual by M. Chevandier, of Die, in France. (See *Archives Gén.*, 4e sér., xxviii. 80.)

A long journey often acts very usefully as an alterative; and, perhaps, no means of cure is more effectual than residence in a warm climate during the colder seasons. Vigorous exercise sometimes proves an effectual remedy. The patient should always wear flannel next his skin, unless in the very hottest weather, when silk may be substituted. The diet must be adapted to the state of general excitement, and the degree of inflammation. Confinement to milk and vegetable food, or even to vegetable food alone, may sometimes be desirable; but generally it is sufficient to take care that the articles employed are digestible, and not likely to irritate the stomach.

Local Remedies.—These are scarcely less numerous than the general. Occasional *leeching* or *cupping* is often very useful; but, when the disease is fixed permanently in one or a few parts, and does not change, repeated *blistering* is incomparably superior to all other remedies. The part should be covered with the blister, and, as quickly as one heals, it should be followed by another. Caustic issues and moxa are sometimes used; but I prefer blistering. Great benefit is said to have accrued from the application of iron, heated somewhat above the boiling point, and made to touch the surface of the affected part, at various points, in quick succession.* In mild cases, *rubefacient* and *anodyne liniments* may be used with benefit. A great variety of these liniments have been employed both in regular and empirical practice. They generally contain camphor, one or more volatile oils, such as those of origanum, rosemary, turpentine, and horsemint, and some preparation of opium. The vehicle is generally alcohol. Probably none are better than the officinal camphorated soap liniment, or camphorated tincture of soap, to which laudanum may be added. Ammoniacal liniments, with or without laudanum, are often used. The *bitumens* enter into some nostrums. *Poultices containing carbonate of soda* are said to have proved beneficial. Friction with *castor oil* has been recommended. The *tincture of iodine* has been applied advantageously to the surface of the inflamed part, and has been particularly recommended in disease of the joints. *Plasters of aconite, belladonna,* &c., may be used when the part is very painful. Other local remedial measures which have been recommended, and occasionally prove useful, are *electricity; compression by means of a flannel or muslin roller; a thin covering of caoutchouc; the soap, ammoniac,* or *compound galbanum plaster,* in affections of the joints; *diligent frictions;* and in some instances *exercise,* in others *rest* of the affected parts.

4. OF NERVOUS RHEUMATISM.—The treatment of this affection is so exactly like that of the analogous variety of gout, that I shall content myself with referring the reader to that disease.

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* This process is called *firing*. Dr. Corrigan, of Dublin, has suggested a neat mode of applying it, with very little pain to the patient. A thick iron wire, about two inches long, is at one end inserted into a small wooden handle, and, at the other end, which is slightly curved, attached to a disk of iron, one-quarter of an inch thick, and half an inch in diameter, and with its face quite flat. The disk of iron is to be heated in a spirit-lamp, until the finger, placed on the wire half an inch above it, becomes uncomfortably hot, and is then to be applied very lightly to the skin, passing as rapidly as possible from point to point, at intervals of half an inch, until the whole surface over the affected part has been touched by it. The whole flat surface of the disk should be made to come in contact with the skin. The spots touched become instantly white, and in a few minutes the whole surface is reddened; but an eschar is never formed, and very seldom a blister, if the operation be well performed. Instant relief is often obtained, and not unfrequently a permanent cure is effected. Dr. McCormack, of Donegal, speaks in the strongest terms of the efficacy of this treatment. (See *Braithwaite's Retrospect,* N. Y. ed., xiii. 55, and xv. 82.)

Article II.

GOUT.

Syn.—Arthritis.

This is a constitutional affection exhibiting itself in a peculiar irritation or inflammation in various parts of the body, of which probably no one vital portion or tissue is at all times exempt. The modern name *gout* was derived from the Latin *gutta* (drop), probably through the French *goutte*, and owed its origin to an old pathological notion, that a peculiar liquid matter, upon which it was supposed that the disease depended, fell drop by drop into the affected joint. To the ancients the disease was known under the general designation of *arthritis*; and particular names were given to it, according to the part in which it was seated, as *podagra* when in the foot, and *chiragra* when in the hand.

Various divisions of the disease have been made by authors, and given rise to as many different designations. Thus gout is called *regular* or *irregular*, according as it pursues or deviates from the ordinary course; *tonic* or *atonic*, according to the accompanying strength of system, and energy of local action; *acute* or *chronic*, according to its duration and violence; *misplaced* when it appears originally in some part not ordinarily attacked by it; and *retrocedent*, when, having occurred externally, it leaves its position, to seize upon some interior organ.

It has appeared to me that the disease may be most conveniently considered under the three divisions of *acute*, *chronic*, and *nervous gout*. There are cases which might be denominated *sub-acute*; but they are much less frequent relatively than the analogous cases of rheumatism, and I have not deemed it necessary to make a distinct class of them. I shall first describe these varieties separately, and afterwards treat of them conjointly in relation to their causes, treatment, &c.

1. *Acute Gout.*

Symptoms, Course, &c.—This form of the disease occurs generally in persons of vigorous constitution, and at an age when the powers of life are most fully developed. It is characterized by paroxysms of acute inflammation, generally confined at first to one spot, especially one of the smaller joints, and attended with fever. The disease appears to have a singular predilection for the metatarsal joint of the big toe. Sometimes it first attacks the *ball* of the foot, or the ankle, and occasionally one of the finger joints, or the wrist. Of 193 cases compared by Scudamore, 130 began in the joint of the great toe, and all but 8, in the smaller joints or the ankle of one or both feet. After the disease has repeatedly recurred, it often deviates from its original course, and the paroxysm may commence in any one of the joints of the body, or even in an interior organ, though it still shows a preference for the parts originally affected.

In the ordinary regular form of the disease, the patient is seized, either after a longer or shorter duration of certain preliminary symptoms, or abruptly, in a state of apparently sound health, with acute pain in the large joint of the great toe, or in whatever other part is to be the seat of the inflammation. This pain is sometimes intensely severe, and is described by patients as tearing, rending, boring, piercing, &c., as if the joint were torn by pincers, or penetrated by a gimlet or a nail, or were under the action of a saw. At first, there is little or no appearance of inflammation; but the joint soon begins to swell, the skin becomes hot and of a bright-red colour, and the tenderness is so exquisite that the least jar is intolerable, the weight even of the bed-clothes cannot be borne, and the patient dreads the approach of any one, lest by accident the limb might be touched. A characteristic phenomenon of the gouty inflammation is the turgescence of the superficial veins, not only near the part, but for some distance up the limb. These symptoms continue with little abatement for six, eight, twelve, or even twenty-four hours, after which the excessive violence of the pain subsides, though the swelling rather increases than diminishes, becoming somewhat edematous, and appearing to contribute towards the relief of the previous acute suffering.

The attack is apt to take place in the middle of the night, the patient being awakened out of sleep an hour or two after midnight by the violence of the pain. In such instances, the affection not unfrequently continues, with little relaxation, until about the same time on the following night, when the patient falls asleep, and wakes in the morning much relieved, and perhaps moderately perspiring.

Simultaneously or nearly so, with the local affection, febrile symptoms make their appearance, commencing usually with chilliness or rigors, which are followed by acceleration of pulse, increased heat of skin especially of the face, loss of appetite, a furred tongue, constipated bowels, and scanty, high-coloured, lateritious urine. Not unfrequently the discharges from the bowels are pale, or green and offensive, indicating deficient or deranged action of the liver; and sometimes an unpleasant odour exhales from the surface. The febrile symptoms remit, along with those of the local affection. But the paroxysm is not yet ended. Both the inflammation and the fever undergo an exacerbation towards evening, which continues more or less through the night, to abate again in the morning; and this daily alternation goes on for a length of time, varying greatly in different cases, but, in the early attacks of the complaint, generally not exceeding a week or ten days, and not unfrequently falling short of the first mentioned period.

The pain and fever generally leave the patient before the swelling; and their disappearance is sometimes attended with a looseness of the bowels, or the occurrence of perspiration, or a copious discharge of urine, which deposits a lateritious sediment on cooling. The remaining tumefaction, which is usually edematous, now gradually subsides, and the affection terminates in a desquamation of the cuticle of the part, often attended with itching.

After the first attacks of the disease, the affected joint is restored perfectly to its functions, and the patient generally enjoys, for some time, an unusual exemption from morbid sensations, and considers himself in better health than before.

It is not always, however, that gout begins as above described. Sometimes, before the occurrence of a severe and regular paroxysm, there are several slight attacks, at distant intervals, of pain and soreness in some part of the foot or hand, which are insufficient to confine the patient, and which he is often disposed to ascribe to a sprain, or other accident. In other instances, the attack begins moderately, and gradually increases until it becomes severe and febrile, and then as gradually subsides.

The existence, in certain cases, of disordered symptoms preliminary to the onset of the paroxysm, has been already referred to. These are not unfrequent. Indeed, to a greater or less extent, they are experienced in the great majority of cases. In character, degree, and duration, they are exceedingly diversified, being sometimes so mild as scarcely to attract attention, in other instances very distressing; occasionally lasting only a few days, and again persevering, with greater or less steadiness, for months or years. Most of them will be more particularly described under *nervous gout;* as they are often the same as those which characterize that variety of the disease. It is sufficient here to say that they are, for the most part, either simply neuralgic, or such as indicate mere disorder of function. Among the most prominent of the latter are dyspeptic sensations, an impaired or craving appetite, acid eructations, flatulence, deficient or deranged biliary secretion, a tendency to constipation or looseness, nephritic disorder, occasional palpitations and dyspnœa, giddiness, buzzing or roaring in the ears, dimness or other disorder of vision, and emotional irregularities, as depression of spirits, hypochondriacal notions and unusual irascibility of temper. Dr. Cullen enumerates, among the premonitory symptoms, "the ceasing of a sweating which the feet had been commonly affected with before; an unusual coldness of the feet and legs; a frequent numbness, alternating with a sense of prickling along the whole of the lower extremities; frequent cramps of the muscles of the legs; and an unusual turgescence of the veins." Not unfrequently, an experienced gouty patient is enabled to foretell an approaching attack by the occurrence of some one or more of these symptoms. They generally disappear upon the breaking out of the paroxysm, and so harassing are they in some instances to the patient, that the inflammation of the joint is welcomed as a relief. After the subsidence of the inflammation, if it has been severe and of the usual duration, the system seems to have been cleared of some offending cause, and the patient enjoys for a time excellent health and spirits.

It seldom happens that an individual has only a single paroxysm of acute gout. In some rare instances, the patient has been able, by a complete change of habits, to throw off the gouty tendency, and has escaped a second attack. But generally the disease recurs sooner or later. Sometimes the second paroxysm does not occur for three or four years, or even longer; but usually it makes its appearance in a year; and the returns afterwards continue to be annual, and, with remarkable uniformity, at about the same season, even in the same month. As the disease advances, the length of the paroxysms increases, while the intervals shorten. Intead of lasting from five to ten days, as at first, they continue for two or three weeks, or longer; and, instead of returning annually, they make their appearance twice a year, afterwards four times a year, and at last so frequently that, with their longer duration, the patient is hardly ever quite exempt. At this stage, one paroxysm does not completely subside before another appears; so that the patient labours under a remittent disease, except, perhaps, for six or eight weeks, in the middle of summer, when the gouty symptoms leave him.

In its first returns, the disease is generally confined, as in the beginning, to a single joint, and often to the one originally attacked; but this tendency to fixation diminishes with the progress of the case, and at length the inflammation occurs in some other joint, or, after appearing in one, passes into another, and thus sometimes successively attacks the joints of the foot, the ankle, the knee, the fingers, wrist, elbow, &c. In some instances, though thus migrating from point to point, it occupies but one position at a time; in others, it affects several joints simultaneously, though even in these, one is generally more inflamed than the others.

As the local affection thus extends, both in duration and position, it loses much of its violence. The pain is less intense than in the earlier attacks, and there is also less redness. The swelling, it is true, is often greater; but it is less tense, and more edematous. The grade of the inflammatory action has obviously lowered, corresponding, in this respect, with the diminished energy of the system. The joint, after the paroxysm is over, does not now so completely recover its natural healthy power as at first; but is apt to remain stiff, and sometimes becomes almost incapable of motion.

The febrile action is also less vigorous than in the earlier paroxysms; but the patient is more troubled with the internal symptoms before alluded to previously to his attack, and gets less thoroughly rid of them when the local affection subsides. During the continuance of the paroxysm, he is more liable to be affected with visceral disease; and attacks of gouty inflammation or irritation in the stomach, bowels, kidneys, liver, lungs, heart, and brain, are more apt to occur, whether originally, or in consequence of the retrocession of the external affection.

In this advanced stage, the gout may be considered as having passed from the acute into the chronic state.

Without losing its claim to be ranked as acute gout, the disease not unfrequently, at all stages of its progress, retrocedes from the extremities to fix upon some interior organ, or attacks one of these organs without having appeared externally, constituting what has been called *misplaced gout.* Either of these events may happen, through the influence of causes calculated to fix an irritation in any one of the viscera, and thus to invite the morbid tendencies of the system to concentrate themselves upon it. Retrocession may result from anything which tends to put an end to the external inflammation, without, at the same time, correcting the general diathesis; as, for example, the application of cold to the affected joint. Fatal metastasis has often resulted from this cause. It may be stated, in general terms, that the greater the energy of the system, the stronger is the disposition of the disease to fix itself, in a highly inflammatory form, in its legitimate external seat; and that, consequently, whatever tends to debilitate the system, renders the occurrence of retrocedent or misplaced gout more frequent. It may be proper to refer briefly to the phenomena of the disease in the more important organs.

In the *stomach*, gout may occur in two distinct forms; the inflammatory, namely, and the nervous or functional. In the former, the symptoms are those of acute gastritis. There are burning pain, exquisite tenderness upon pressure, and not unfrequently nausea and vomiting. If not depressed by the state of nausea, the pulse has considerable volume and strength; but, in the other case, it may be slender and feeble, with a cold, pale, damp surface, which may readily be mistaken for evidence of debility. Sometimes the brain sympathizes with the stomach, and stupor attends the gastric inflammation. I have seen a case of this kind, in which the patient appeared perfectly insensible to ordinary impressions, but exhibited, by a violent and convulsive start, evidence of extreme pain, when a very slight pressure was made on the epigastrium. It is important not to confound such cases with cerebral inflammation. The case in question yielded at once to remedies applied to the stomach.

In the nervous or functional affection, there is either violent spasm, or oppression, distress, nausea, and vomiting, according as the muscular or mucous coat is the seat of irritation. But the burning pain is wanting, the tenderness on pressure is less, and, instead of febrile action, there is often great prostration, with a cold clammy skin, and an alarming feebleness of the pulse.

The *bowels* are sometimes attacked in the form of diarrhœa or of colic. In the *heart*, which, however, is rarely affected in acute gout, precordial oppression, dyspnœa, sharp pains, and syncope more or less complete, may be produced. In the *lungs*, symptoms of intense bronchial congestion sometimes appear, with difficult breathing, great anxiety and distress, a purplish or livid hue of the face and hands, a feeble pulse, and coolness of the surface. I have seen symptoms of this kind promptly relieved by the loss of blood from the arm. But sometimes the pulmonary symptoms are those rather of nervous than vascular irritation, and appear in the form merely of dyspnœa or asthma. The *diaphragm* is sometimes affected, with symptoms similar to those which occur in rheumatism of the same organ. The *liver* is less frequently inflamed than functionally deranged. Deficient, depraved, or superabundant secretion of bile is among the most common internal derangements of the system in gout; so common, indeed, that some have supposed the disease to be essentially connected with hepatic disorder. Hence the clay-coloured, soap-like, or green and offensive stools, and the bilious vomiting and purging, which often attend the gouty paroxysm.

The *kidneys* are probably more frequently affected than any internal organ. Gravelly symptoms are not uncommon during the paroxysm, consequent upon the excess of uric acid or the urates in the urine. But genuine attacks of nephritis alternate, in some individuals, with external inflammation; and retrocedent gout occasionally seizes upon these glands. It is not difficult to explain this fact. In gout, there is often an excessive production of uric acid, which, thrown off with the urine, irritates the pelvis of the kidney and its excretory duct, thus rendering these parts the centre of afflux for the gouty tendencies, when anything may unseat the disease of the joints. Sometimes the inflammation fixes on the *urethra*, producing purulent discharge, scalding pain upon the passage of urine, and other symptoms analogous to those of gonorrhœa.

Occasionally, the gouty irritation displays itself in the *skin*, producing the phenomena of urticaria, erythema, or other exanthematous eruption.

The *brain* is sometimes attacked by acute gout, with the production of stupor, and occasionally of complete apoplexy or palsy. The *eye* also may suffer. One of the most obstinate instances of ophthalmia that have fallen under my notice, was in a gouty patient. The eye appeared to have become the point in which the force of the disease centred; and, though it was frequently relieved for a time, a new paroxysm would restore the inflammation; and the affection was thus sustained for more than a year, and did not yield at last, until the gouty tendencies appeared, of their own accord, to take another direction. It is unnecessary further to extend the list of parts which may become the seat of gouty inflammation. The probability is, that no part of the system, possessed of a capacity for the inflammatory process, is entirely exempt. The organs most frequently and prominently affected are probably the stomach and kidneys. It is often difficult, in relation to the attacks of misplaced gout, to determine whether the inflammation is of the common kind, or of gouty origin. The occurrence of a regular paroxysm, and the consequent relief of the disease in its irregular seat, or the alternation of the two affections, is the best diagnostic sign. But one of these attacks, occurring in a gouty individual, may generally be suspected of the gouty taint, and treated accordingly with good effect.

When the gouty diathesis exists in a person of otherwise feeble health, or debilitated system, though it may still show itself in the form of external inflammation, yet this will be of a lower grade than in more vigorous individuals, more disposed to change its position, and more apt consequently to fix upon the internal organs. In these cases, the internal affections often do not rise above the grade of nervous or functional disease, and, therefore, belong to nervous gout; but sometimes they are slightly inflammatory, though less dangerous than similar affections attending the more sthenic cases.

Gout is not generally regarded as a very dangerous disease; and many who suffer under it console themselves with the reflection, that it serves to guard the system against others more dangerous than itself. There is probably some truth in this impression. In gouty individuals, the causes which ordinarily produce internal inflammation may be directed, by the peculiar tendencies of the constitution, to an external and comparatively safe position. Yet gout itself is not unfrequently fatal. In the earlier stages, the greatest danger is from internal seizure, whether original or by translation; and every now and then we hear of a victim to gout in the stomach, the brain, or the heart. These cases, however, are comparatively few. It is from the slow wearing influence of the disease, every year extending its sway more and more over the constitution, which every year becomes less and less able to resist it, that the greatest danger arises. The internal vital organs, by the frequent stress to which they are exposed, become at length so far weakened or deranged that slight causes give rise to the most serious effects. Hence fatal attacks of apoplexy, of pulmonary congestion or inflammation, and of cardiac disease. But one of the most frequent terminations is in dropsy, consequent either upon general debility, or organic visceral disease, as of the heart, liver, lungs, or kidneys. In this condition, however, the affection may be considered as having assumed the chronic form.

2. *Chronic Gout.*

Symptoms, Course, &c.—Chronic gout is generally the result of a long continuance of the acute, though sometimes the disease is of the chronic grade from its commencement. The period at which it takes on this form varies greatly in different persons; those of vigorous constitutions retaining the acute symptoms much longer than the feeble. The boundary between the two states of gout is altogether arbitrary. The one runs into the other by imperceptible gradations. The disease may be considered chronic, when the local affection is not sufficiently active to produce fever.

In this condition of gout, the paroxysms are more frequent than in the acute, but much less severe. There is often little pain unless upon motion of the joint. There is also little increase of heat; and redness is either entirely absent, or of a purplish hue. When there is swelling, it is usually edematous. Not unfrequently, the synovial liquid of the joints, and the fluid of the neighbouring bursæ, are so much increased as to produce a considerable appearance of tumefaction, and to fluctuate obviously under pressure. This is particularly the case in the knee and the elbow.

The paroxysms occur less regularly than in the acute form; sometimes coming at intervals of a month, sometimes of two or three months. They also last much longer; and it not unfrequently happens that they run into each other, a fresh attack coming on before the preceding one has quite subsided; so that the patient is scarcely ever free from disease.

In some instances, the disease is fixed in certain joints; in others is more or less movable, wandering from joint to joint, now attacking one part and now another, and not unfrequently retroceding from the surface to seize upon one of the interior organs. In the latter form, the local affection is apt to be more painful, and to exhibit more redness than in the former; and the case might, perhaps, in many instances, be considered as rather a mixture of the acute variety, in its mildest grade, with more or less of the nervous, than as strictly chronic.

In the more fixed form of chronic gout, the joints often become permanently altered, so as to bend with difficulty, and sometimes to be nearly or quite useless. This arises partly from a thickening or other structural change of the ligaments, partly from the deposition of insoluble earthy matter, like chalk, either in the cavity of the joint, or in the cellular tissue about it. This deposition is more especially apt to occur in the joints of the fingers. The earthy matter is first extravasated in a liquid, or semi-liquid state, and afterwards becomes dry by the absorption of the fluid parts. The tumours which it forms are called *chalk stones*. They vary in size from that of a mustard seed to that of a walnut, and are sometimes very numerous, forming large masses about the knuckles and other joints. They have been found upon chemical analysis to consist chiefly of uric acid or its compounds, especially urate of soda. Sometimes they contain also urate and phosphate of lime. By their pressure they cause an absorption of the soft parts, and their white surface may sometimes be seen through the cuticle, with which they have come into contact in consequence of the destruction of the true skin. Occasionally they produce much swelling in the neighbouring parts, with a purple redness which appears to threaten mortification, and the collection of a considerable quantity of serous fluid beneath the cuticle. This at last breaks, and the fluid escapes along with portions of the chalk-like matter, but without pus at this stage. Subsequently, however, suppurating ulcers are formed, which continue open for a long time, and prove very rebellious to treatment. The earthy matter, being contained in the cells of the areolar tissue, is not readily discharged, and art can do little to hasten the process. At length, however, the whole of the offending cause is eliminated; and the ulcers heal; or cicatrization takes place, notwithstanding that portions of it may be retained in the tissue beneath. Old gouty individuals have sometimes been able to write with their knuckles, in consequence of the exposure of the chalky tumours in the vicinity of the joints. It is an interesting fact, ascertained by Dr. A. B. Garrod, of London, that in cases attended with this deposition about the joints, there is a deficiency of uric acid in the urine, and an excess of it in the blood.

Another peculiarity of chronic gout is the formation of small hard nodosities upon the surface or in the substance of the tendons. These sometimes increase till they attain a considerable size. In most instances, they are without pain, but not always so. They sometimes consist of the chalky matter surrounded by a dense membranous coating, sometimes apparently of the hypertrophied tissue of the tendon.

Though fever is not a regular attendant upon chronic gout, and is often quite absent, a slight degree of it sometimes takes place, when a fresh accession of inflammation occurs, or some internal disorder is superadded. The patient has a pale or sallow complexion, a flaccid state of the flesh, and the general aspect as of one worn by long-continued ailment. He is frequently troubled with dyspeptic symptoms, functional disorder of the liver and kidneys, irregularity of the bowels, and acute muscular pains, sometimes attended with cramps, in various parts of the body. Unless cut off by some acute disease which the debilitated state of his system is unable to resist, he at length falls into general dropsy, suffers with serous effusion in his chest, and dies most frequently from an interruption of the respiratory process.

Anatomical Characters.—Dissection has revealed little that is of peculiar interest either in chronic or acute gout. In the former, the synovial membrane of the affected joint, and the interarticular cartilages, exhibit evidences of inflammation; the cartilages covering the articulating ends of the bones are sometimes partially absorbed; and the bones themselves near the joints are injected with blood, softened, and occasionally eroded. The external ligaments, though less affected, are sometimes injected and thickened, and the muscles in the neighbourhood wasted or rigidly contracted. Layers of chalky matter are found, in some instances, either within the synovial membrane, or between it and the cartilages; and the same matter, without the joints, is observed in the cells of the areolar tissue, in the muscles, fasciæ, ligaments, and periosteum. In cases of death from internal inflammation, the ordinary signs of that affection are exhibited; but pathological anatomy is not rich in records of this kind; partly, perhaps, because death from this cause seldom occurs in the hospitals.

3. *Nervous Gout.*

Symptoms, Course, &c.—This form of gout is sometimes quite distinct from the others; but is generally more or less mingled with them, constituting cases which have been described by various names, as *irregular gout, atonic gout, movable chronic gout,* &c. It is apt to affect persons who have inherited a gouty diathesis, but, from original temperament or abstemious habits, are little liable to inflammation. Women, and individuals generally of a nervous temperament, who have descended from gouty ancestors, are very liable to it. Sometimes all the members of a family are prone to it; or the female members may be affected with this variety of the disease, while the males, from their more active habits, and freer lives, are attacked with the acute form. There is reason to believe that it is much more common than formerly, having, to a considerable degree, superseded the old-fashioned gout, probably in consequence of greater temperance in the modern modes of living. I have no doubt that much of the neuralgia, now so prevalent, is only gout or rheumatism in the nervous form.

It may be asked how the disease is known to be of the gouty character. It may be reasonably suspected to be so, when the person affected has had gouty parents or grandparents, and no other cause can be detected. Its frequent intermixture or alternation with slight attacks, or abortive efforts at external inflammatory gout, raises the suspicion pretty nearly to certainty. An individual has an attack of regular gout, which relieves him from various functional derangements, to which he has long been subject. Alarmed for the future, he changes his mode of life, avoids all stimulating drinks, uses animal food in great moderation, and finds himself, for the remainder of his life, exempt or nearly so from inflammatory paroxysms, but, in place of them, is frequently harassed by this variety of the disease, in some one or more of its protean forms.

Nervous gout shows itself in the form either of simple neuralgic pain, or functional disorder. The pains may be dull and constant, or sharp, lancinating, and intermittent, and may occur in any part of the body. Sometimes they remain long fixed in certain parts; but are more frequently changeable, appearing now in one part and now in another, without any regularity in their course. I have known an individual who was for many years subject to a fixed pain in the region of the liver, without the least sign of hepatic derangement, and in whom the pain suddenly disappeared upon the occurrence of an attack of insanity, to return again when the insanity ceased. That the affection was of the character supposed, was evinced by occasional external attacks of the disease in a subacute form. It is not uncommon for a fixed pain of this kind to continue for months in one spot, varying, however, very much in intensity, and sometimes scarcely noticed, and then to disappear without any obvious cause, to be followed at a shorter or longer interval, or immediately, by a similar pain elsewhere, or by some functional derangement of one of the internal organs. The right iliac region, the precordial region extending to the left arm, the right side of the chest, and the scalp, are not unfrequent seats of it. *Hemicrania* is one of the forms which the disease sometimes assumes.

The severe shooting neuralgic pains are more especially apt to occur in the temples, cheeks, or front part of the upper and lower jaws, though they may also attack the extremities, particularly the smaller joints, the generative organs, the anus, and any one of the viscera. Not unfrequently, they attack the muscles, which thus become painful on contraction.

Sometimes these pains, as well as various functional disorder, are found to be dependent on the disease seated in one of the nervous centres, or in the neurilema of one of the larger nerves, from or through which nervous influence is extended to the part affected. Thus, pains in the trunk and extremities may proceed from the disease in some portion of the spinal marrow, or its envelope. But, in most instances, the pains can be traced to no such origin, appearing to be the direct result of the morbid cause.

Let us now turn our attention to the several functions. The *digestive function* is among those most frequently deranged. All the varieties of disordered sensation which usually attend dyspepsia are experienced in this affection. Vague uneasiness in the epigastrium, a feeling of weight or oppression, irregular appetite, cardialgia, sour or acrid eructations, flatulence, sometimes nausea and vomiting, sometimes severe spasm, are among the prominent symptoms. The bowels are generally costive, occasionally loose, with frequent deficiency of bile, or other unhealthy condition of the stools. Colicky pains, and flatulent distension are not uncommon. Sometimes the patient suffers with severe neuralgic pains in the bowels.

The *respiratory function* is occasionally also much deranged. The larynx is now and then the seat of irritation, and the patient is worried with a frequent cough, which might well be mistaken for pectoral without care. I have a patient subject to this form of gout, who was at one period afflicted with an incessant cough, which continued for months, and scarcely ceased for a minute except during sleep and meals. Paroxysms of oppression and dyspnœa, almost like those of spasmodic asthma, indicate the existence of the disease in the lungs.

The *circulatory system* is often greatly disordered, as indicated by precordial oppression, palpitations, darting pains in the region of the heart, intermittent and irregular pulse, and sometimes syncope, or a strong tendency towards it.

Of the *secreting organs*, the liver and kidneys are most frequently affected. When the irritation seizes upon the former, together with a dull pain in the side, or an indescribable uneasiness in the whole upper region of the abdomen, there is frequently deficiency of bile, with pale or clay-coloured stools, and a sallow hue of the surface, or excessive secretion with bilious vomiting and purging, or black stools approaching to melæna; or there may be derangement of the secretion with little local uneasiness, though the affection is almost always attended with depression of spirits. Excessive secretion of a pale urine, or a scanty secretion of a red urine loaded with uric acid, and sometimes a dull pain in the small of the back, or pains like those of gravel, indicate that the kidneys are affected.

The *sensorial functions* are often greatly disturbed. Vertigo, dizziness, tinnitus aurium, perverted vision, muscæ volitantes, and violent headaches are common symptoms. Sometimes even coma and convulsions are experienced. These cephalic attacks are often very sudden. A person will be feeling perfectly well, and as if capable of performing any duty effectively; when suddenly he will be seized with vertiginous pain in the head, with roaring or other distracting noises in his ears, and often some perversion of vision, and immediately all his energy is lost, and he feels himself quite incompetent to the least exertion. Sometimes the eyes become extremely sensitive, so that any attempt to use them, even for a few minutes, occasions intolerable pain. Every variety of mental depression accompanies these affections of the head. The spinal marrow and nerves become not unfrequently the seat of irritation, which displays itself in irregular muscular contractions, cramps or spasms, and occasionally a vague and unaccountable uneasiness, extending through the limbs, with a universal feeling of oppression, heat, anxiety, weariness, soreness, &c., which they only can fully appreciate who have felt them.

These various disorders usually occur quite irregularly, the irritation being sometimes in one part, sometimes in another; in certain instances fixed for days, weeks, or months in a single organ or function, in others rapidly changing its seat; occasionally leaving the patient entirely, with the most exquisite sense of freedom from suffering, and the best hopes for the future, then returning, and often without apparent cause, with all its former violence.

Not unfrequently the disease assumes a regularly intermittent form, returning at a certain hour every day, and leaving the patient entirely in the interval.

As before stated, an attack of subacute inflammation occasionally takes place in an exterior joint or muscle, and affords a temporary relief to the nervous irritation; and there are, perhaps, few patients in whom, at one period or another, the disease does not afford this evidence of its nature.

This form of gout does not often directly destroy life. Sometimes a quick and violent seizure of one of the vital organs, as the heart or brain, appears completely to arrest its function, and thus to occasion sudden death; but instances of this kind are rare. More commonly the patient lives many years, perhaps in some instances surmounting the affection, but more frequently falling a victim to some incidental disease, or worn out at last by chronic organic derangements in which the functional disorder may finally terminate.

Causes of Gout.

The most frequent cause of gout is inheritance. This not only gives a predisposition, but is sufficient of itself, wholly without aid from other causes, and even in opposition to whatever influences can be brought against it, to give rise to the disease. It does not follow that every child of gouty parents must inherit the diathesis. On the contrary, many escape entirely. But the proportion of those affected is so great as to offer a strong warning, to all who are thus descended, to use every possible preventive measure. Of 522 gouty patients, of whom Sir C. Scudamore collected information, 822, or nearly two-thirds could trace the disease to a parent, grandparent, uncle, or aunt.

But, though so frequently hereditary, there is no doubt that the gouty diathesis may be created. Persons out of classes in society among whom the disease is almost unknown, if removed from the sphere occupied by their forefathers, and introduced into modes of life which dispose to the complaint, are frequently attacked with it. It is generally believed that the most efficient causes in generating the gouty diathesis, and consequently in promoting it when inherited, are the use of animal food in undue proportion, especially of high-seasoned meats and soups, indulgence in alcoholic drinks, and sedentary habits. Vigorous exercise may, to a considerable extent, obviate the effects of high living, by consuming the excess of blood in the support of the functions.

From the nature of its causes, the disease would naturally be looked for among the wealthy and luxurious, or their descendants; and it certainly is much more common in the higher than the humbler walks of life. It is very rare among an agricultural or hard-working population, in any part of the globe. Yet the same causes will produce the disease among any class of people; and persons in the lowest grades of society are found to be attacked by it, when they imitate the luxurious habits of their superiors; as the keepers of petty inns, and household servants in the wealthy families of Europe. It has been supposed that intellectual superiority favours the developement of gout; but, if the disease has been common among men celebrated for their mental powers, it has probably been much more from the union of sedentary with convivial habits, than from any influence either of superior talent or its exercise.

In relation to the influence of alcoholic drinks, though there is little or no difference of opinion as to the general fact, yet writers are by no means agreed as to the varieties which are most apt to produce the effect. Some have supposed that the light, acescent wines peculiarly predispose to gout. It is probably true that the use of them will often bring on a paroxysm of the disease, in those who have the diathesis, more quickly than the stronger wines, perhaps by irritating the stomach; but it is certainly not true that they are more apt to generate the diathesis; for the agricultural classes of France, who use the lighter wines often as their common drink, are said to be almost wholly exempt from the disease; while the English gentlemen, who drink freely of port and other stronger wines, are said to be more frequently than any other people affected with it. The same may be said of cider, which has been accused of inducing gout. It may act sometimes as an exciting cause, but will probably seldom produce the predisposition. Otherwise, gout would have been formerly much more common than it was among the people of New England, and the middle Atlantic States, in which this drink was very commonly employed by the country people. The very free use of malt liquors, particularly of the stronger kinds, has frequently been known to generate the disease, even among the lowest classes of the population. It is probable that strong ale or porter, and the stronger wines, are more conducive to the disease than other alcoholic drinks. The distilled liquors, when freely indulged in, though they sometimes contribute to the production of gout, appear generally to exhaust the excitability of the system below the point requisite for the developement of that disease, and conduce rather to internal visceral disorder, with a tendency to the mania of drunkards. It is probable that habits of vigorous exercise, in persons who use strong drinks to great excess, so far from warding off gout, as they do in moderate drinkers, have a tendency to generate it, by sustaining a certain degree of energy in the system, which seems requisite for the developement of the diathesis.* From what has been said it may be inferred that, so far as alcoholic drinks are concerned as causes of gout, it is not so much the particular variety used, as the mode of using them that has the effect. No matter what kind may be employed, if it be taken in such quantities, and with such associations as to food and exercise, as to support a certain degree of vigour of system in the midst of the repletion and excess, it may give rise to the disease. If it be too feeble to produce this degree of excitement, or so strong and so much abused as speedily to exhaust the excitability and powers of the system, gout will probably not result in either case.

It is a remarkable fact, that, according to the best testimony, acute gout has very much diminished of late years. This is said to be true in England. It certainly is so in this part of the United States. The fact can be ascribed only to the greater prevalence of temperance. Even persons who drink seldom carry the indulgences of the table to that beastly extreme which was common half a century ago. But, though inflammatory gout has greatly diminished, I believe that the nervous form of it has increased; because temperance, or even abstemiousness, cannot eradicate the diathesis when existing, though it may subdue the tendency to inflammation; and they who would, under the old habits of life, have been attacked with the disease in its old-fashioned form, now have it in the shape of neuralgia and functional disorder.

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* A fact strongly illustrative of this statement is mentioned by Dr. William Budd, in his Essay on Gout, in Tweedie's System of Practical Medicine. A body of workmen is employed on the Thames, in a peculiarly fatiguing duty, requiring frequent exposure to inclement weather, and labour both by night and day. In consideration of this exposure and fatigue, they have a large allowance of liquor; and each man drinks daily two or three gallons of porter, besides, in general, a considerable quantity of spirit. Among these men gout is remarkably frequent.

It has been imagined that liability to gout was indicated by the possession of certain sensible characters of body; but the notion has been contradicted by experience; as the disease exists in persons of every variety of structure and outward appearance.

Season is not without its influence. The first paroxysm of gout is very apt to occur about the vernal equinox; and, if the affection return semi-annually, the attacks are usually made in the spring and autumn.

Age has certainly much to do with the developement of gout. The disease generally makes its first appearance between the twentieth and fiftieth year, and most frequently from the twenty-fifth to the thirty-fifth or fortieth. It is exceedingly rare before the age of puberty; though Dr. Chapman has known it to occur in a boy of thirteen. It also very rarely begins in old age. I have, however, attended a gentleman of near eighty in his first attack.

All writers agree in the statement, that the disease is much more frequent in men than women. In relation to the acute and chronic forms of gout, there can be no doubt of the fact. But in its nervous forms, judging from my own observation, I should say that the contrary is true. The female descendants of gouty ancestors are exceedingly prone to nervous gout. Their temperate habits prevent the inflammatory explosions of the disease to which the males are so liable; while their sedentary lives interfere with the attainment of that strength of constitution, which would enable their systems to resist the inherited morbid tendency.

It is thought that a damp, variable climate is peculiarly favourable to the generation of the gouty diathesis. The disease is certainly rare among the inhabitants of intertropical regions, and is less common at the extreme North than in the temperate latitudes, where the weather is more variable. Its great prevalence in England has been ascribed partly to the climate; but it probably depends much more on the habits of the people.

The exciting causes of the gouty paroxysm are exceedingly numerous. Whatever, in fact, disturbs materially the condition of health, whether it be of an exciting or debilitating character, is probably capable of bringing on an attack. Exposure to cold, violent exercise, a debauch at table, venereal excesses, paroxysms of anger or other strong emotion, indigestible food, articles of diet which disagree with the idiosyncrasy of the patient, vegetable acids, and local injuries of all kinds, such as falls, bruises, sprains, and even the wearing of a tight boot, may act as exciting causes. I have repeatedly known the nervous form of the disease to fix, in the shape of neuralgia, upon a part which had been bruised or otherwise injured. This is a fact worthy of recollection; as it will often enable the practitioner to explain unusually obstinate pains attending slight local injuries, and immediately to apply the proper remedy. A severe sprain sometimes leaves behind it a condition of the joint which long afterwards determines this as the seat of an attack of acute gout.

Nature of Gout.

The humoral pathology taught that the phenomena of gout were owing to a peculiar peccant matter existing in the system, which it was the business of the paroxysm to eliminate. This opinion, abandoned after the times of Cullen, is again gaining ground, and ranks at present among its advocates men of high name in the profession, of whom not the least conspicuous is Dr. Holland. (See *Medical Notes and Reflections.*) The fact which lends the strongest support to this opinion is the tendency evinced in gout to the excessive production of uric acid. Not only is that acid thrown out in excess in the urine, giving rise to frequent lateritious sediments, but it is also often deposited in the joints, or their vicinity, in the state of urate of soda or of lime. Dr. Garrod has proved by chemical examination that the blood in gout contains urate of soda, which can readily be separated from it in a crystalline state. He has also shown that, before the occurrence of the gouty paroxysm, there is, along with this excess of urate of soda in the blood, a deficiency of uric acid and its salts in the urine. The use of an excess of animal food, with insufficient exercise, which disposes to an excessive production of uric acid, predisposes also to gout; and the uric acid lithiasis, or gravel, not unfrequently alternates with that complaint. But these arguments, as well as others drawn from the movable character of the local disease, as if it depended upon an offending matter carried everywhere with the blood, and from the relief experienced after the paroxysm, as if the offending matter had been discharged, appear to me to be inconclusive.

Uric acid, I think, certainly cannot be the matter in question. This substance is generated in excess, and thrown out by the kidneys, in many diseases in which no sign of gout is exhibited; and cases of gout often exist, especially in its irregular forms, in which there is no evidence whatever of an excess of uric acid. Nor can I exactly perceive how the production and elimination of this matter, if not itself essential to gout, should lend any support to the idea of the existence of some other unknown and concealed matter, which is the real offending cause. It is possible that there may be such a substance; but its existence, not to mention its nature and properties, has certainly never yet been demonstrated.

Some pathologists search for the origin of gout in disease of a particular organ. The disciples of Broussais consider it simply an inflammation, which they would denominate *gastro-arthritis* from its supposed chief seats. Dr. Chapman refers its origin to some disease of the digestive organs. It has even been supposed to be essentially connected with disease of the liver. The fact, I think, is, that its nature is yet unknown; and, though the uneasiness of a state of acknowledged ignorance will probably continue to induce the formation of hypotheses, in which the mind may find a temporary rest; yet, until some new light is obtained, they can be nothing more than conjectures, which will probably in the end prove to be without foundation. It appears to me, however, that no explanation of the nature of gout can be correct, which does not take into view the nervous phenomena. The violent pain which often precedes the inflammation, the frequent attacks of pure neuralgia, the rapid and almost instantaneous transfer of disease from one part to another, even the most distant, together with the frequent sensorial disturbance, and striking emotional phenomena, evince, I think, beyond doubt, a strong participation of the nervous system in the pathological condition, whatever that may be.

All, of a general nature, that we can fairly deduce from the symptoms is, that there is a morbid state of the system, which probably involves all its essential constituents, and which evinces itself now and then by peculiar local phenomena, which may be either purely nervous, purely functional, or inflammatory. That the inflammation is peculiar or specific is proved by its shifting character, and indisposition to the secretion of coagulable lymph or pus.

Diagnosis.

The only disease with which acute or chronic gout is liable to be confounded is rheumatism. There is no difficulty in discriminating well marked cases of these diseases; but it must be confessed that there are cases in which the diagnosis is difficult, if not impossible; and it is not at all improbable that the two complaints sometimes co-exist, fused, as it were, into one. In such instances, it is common to denominate the affection *rheumatic gout.*

That the diseases are different is evinced, independently of the symptoms, by the difference in their origin, and in the subjects attacked by them. Thus, gout is much more frequently hereditary, and much less frequently generated by obvious causes, than rheumatism. The former almost never attacks children under puberty, the latter does so not unfrequently, though it must be confessed that it is more common in adults. Gout is found most frequently among the wealthy, the luxurious, and the physically idle, and is seldom heard of among those subjected to labour, privations, exposure, and hardships. Exactly the reverse is the case with rheumatism. The circumstance, moreover, already alluded to, that uric acid has been found by Dr. Garrod, in abnormal proportion, in the blood of persons affected with gout, while only a trace of it can be detected in the blood of acute rheumatism, must be received as an evidence of the difference of the two diseases.*

The diagnostic symptoms of gout, in relation to rheumatism, are, chiefly, the more frequent preliminary occurrence of disordered digestion and various functional derangement; the disposition of the disease to fix itself upon the small joints; its paroxysmal form, and tendency to recur at certain periods; the more remittent character of the fever; the greater violence of the pain; the brighter redness of the inflamed part; its greater tumefaction and more decided tendency to œdema; and, finally, the desquamation which follows the subsidence of the swelling. When gout has become chronic, and fixed upon a number of parts, the diagnosis is more difficult. The history of the case will, under such circumstances, afford much assistance. It may be said, in general terms, that the swelling is more apt to be edematous in gout, and the local affection to retrocede, or to leave one part and fix on another; while in pure rheumatism there is probably no deposition of the urates in the joints. Nervous gout can be distinguished from the same form of rheumatism, with any approach to certainty, only by the character of the external inflammation, which occasionally occurs in both affections, and in each may assume the form characteristic of the particular disease.

Of the *prognosis* of gout sufficient has been said in the description of the several varieties.

Treatment.

1. ACUTE GOUT.—The treatment in acute gout naturally divides itself into that which is proper in the paroxysm, and that adapted to the intervals. It was formerly a prevalent opinion, which is still retained by many, that the paroxysm should be allowed to exhaust itself, with little or no interference from the physician. Being designed to carry off offending matter, or at least morbid tendencies, it was supposed that any measures calculated to shorten it would cause its office to be left unaccomplished, and the system exposed to fresh attacks, possibly in unsafe positions. Retrocession to some internal organ was greatly feared; and, as a vigorous condition of system was considered favourable to an external direction of the disease, all depletory measures were especially apprehended. It was, indeed, no uncommon

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* The following is the mode in which Dr. Garrod tests the presence of uric acid in the blood. About a fluidrachm of the clear serum is placed in a deep watch-glass with six minims of strong acetic acid; a very fine fibre of hemp is then introduced; and the glass, being covered with a piece of paper to protect it from the dust, is allowed to remain at rest for about forty-eight hours, when it will probably have become nearly dry. Should uric acid be present in the blood, it will be found to have crystallized on the fibre in the form of rhombs, which may readily be detected with the aid of the microscope. (*Note to the third edition.*)

practice of gouty patients to indulge freely in wine, even during the continuance of the inflammation, with the view of sustaining it, and of guarding the stomach against attack. While there was some truth in this reasoning, the practice founded on it was carried much too far; and the consequences were, that the disease was often greatly aggravated, the sufferings of the patient unnecessarily increased, and life probably not unfrequently shortened. But we should take care not to suffer the bad consequences of the abuse of a sound principle to lead us to abandon it. The paroxysm in gout is certainly not the whole disease. There is undoubtedly a morbid state of system to which the paroxysm is owing, and which it has a tendency to relieve, if allowed to run its course. It is no less true that the removal of the paroxysm has no effect in removing the state of system alluded to. If, therefore, by remedies addressed exclusively to the former, we succeed in cutting it short, we may very possibly leave the latter still in existence, and ready to display itself by some assault, it may be, upon one of the joints as before, or, it may be, upon one of the interior and vital organs. The most prudent procedure, therefore, would appear to be to allow the inflammation of the joint to complete its course; contenting ourselves with moderating its violence if excessive, and endeavouring to render the patient as comfortable as possible. But we may do more than this. We may endeavour to supersede the office of the paroxysm by addressing our remedies to the morbid state of system; and, if we succeed in favourably modifying this, we shall find the local disease disposed to subside without our direct interference. Such, it appears to me, are the correct principles of treatment in the paroxysm of acute gout.

But what are the remedies calculated to modify the constitutional affection? It is experience only which can teach us; for, ignorant of the nature of the general affection, we have no foundation for a purely rational treatment. Bleeding has been proposed. But this remedy has been found to exercise no influence over the proper disease. It may lessen the fever, and cure the inflammation of the joint; but it leaves the source of the evil untouched, while, if incautiously employed, it impairs the vigour of the constitution, and certainly favours the production of various functional disorder. I have known gout, treated by bleeding at each paroxysm, to end prematurely in fatal dropsy. The only proper ground for the employment of this remedy is the existence of danger to life, or risk of serious inconvenience from the violence of the local inflammation, or of the general excitement. When the former is external, and no vital organ appears to be threatened by the latter, it is, as a general rule, best to avoid the lancet.

The same objection does not lie against moderate purging, which appears, indeed, to exercise a favourable influence over the proper disease. Two cautions should be observed in the use of this remedy; the one, not to carry it to the point of exhaustion; the other to employ such substances as are not likely to irritate the mucous coat strongly, so as to make this a centre of afflux to the disease, and thus to relieve the inflammation of the joint, by inducing an attack of gout in the stomach or bowels. As the liver is frequently torpid or deranged, and there is often an excess of acid in the primæ viæ, mercurials and antacids would seem to be indicated. A moderate dose of calomel, or of the mercurial pill, may be given in connexion with rhubarb, and afterwards followed by magnesia, with Epsom salt or other saline cathartic. Should the bowels be torpid, infusion of senna may be used in addition. Afterwards, throughout the attack, one or two stools should be procured daily, if necessary, by means of liquid or common magnesia, or one of the neutral salts, or by the two combined. Should there be colicky pains, with an irritable condition of the bowels, and small, ineffectual discharges, castor oil with laudanum or morphia should be preferred.

But the most effectual remedy in the gouty paroxysm is colchicum. This was introduced into use under the impression that it was the main ingredient in the famous *eau medicinale d'Husson*, which formerly enjoyed a great reputation in the treatment of this disease. When first used, it was generally given in large doses, so as often to purge and vomit; and, in this way, was found not unfrequently to shorten very much, or set aside the paroxysm; but serious consequences were asserted to have occasionally ensued; and the medicine is now given with greater caution, and without evil results. It certainly exercises an extraordinary influence over the disease. But in what manner it does good has not been determined. Some suppose that it acts merely by a revulsive influence, drawing off the external disease from the joint, by establishing irritation in the alimentary canal. It certainly does frequently produce nausea and more or less catharsis, in the doses in which it is ordinarily given; but the same curative influence does not proceed from an equal or much greater amount of the same effects from other substances. It very generally promotes the secretions of the skin and kidneys; and the idea has been entertained that it cures gout by eliminating some offending matter by one of these emunctories. That it is not by a mere increase of these functions that it acts is proved by the fact, that other and more active diaphoretics and diuretics have not been found equally beneficial; and colchicum is believed to be useful even when it exercises no sensible influence over the secretions. It has no decided narcotic property, and, therefore, cannot act as an anodyne. Experiments seem to have shown that the quantity of uric acid and urea in the urine is increased under the action of colchicum; and, with those who consider uric acid in the blood as the offending agent through which the phenomena of gout are produced, this fact affords a sufficient explanation of the therapeutic action of the medicine; but it does not explain how the disposition to the overproduction of this offending agent is obviated, which, even upon the humoral hypothesis, is the real pathological condition. It is by modifying the morbid state which gives rise to the overproduction of uric acid along with the other phenomena, that colchicum cures gout. We may say that it acts as an alterative; which is the same as to confess that we do not understand its mode of action. The general conviction of its usefulness rests upon experience. The objection has been made to its employment that, though it may relieve the existing paroxysm, it leaves the patient liable to a more speedy return. But this view seems to have been theoretical, and has not been confirmed by experience. Different authors recommend different preparations, and seem to attach importance to their particular mode of exhibiting the remedy. Any one of its preparations will, I believe, answer the purpose, which is capable of producing the effects of the medicine on the system. I generally prefer the wine of the root, as the most certain, from its mode of preparation; being a saturated vinous infusion. When the medicine is desired in the form of pill, the acetic extract may be used. After the bowels have been well evacuated, from fifteen to thirty minims of the wine, or from one to three grains of the extract, may be given every four, six, or eight hours, according to the urgency of the case, and the susceptibility of the patient's system. This quantity, if the preparation be properly made, will often produce excessive nausea, or much intestinal irritation, and will require to be reduced. In other cases, it will be necessary to augment the dose somewhat, in order to insure its effect. Given in this way, colchicum often greatly moderates and abbreviates the paroxysm; and, as it does so rather by acting upon the real disease, than merely on the inflammation, its effects are attended with no injury. In order to eradicate the existing tendency, Dr. Budd insists upon the necessity of continuing the use of the colchicum, in small doses, for some time after all the symptoms of gout have disappeared. This is certainly rational practice, if the medicine has really, as it is supposed to have, a direct influence over the gouty state of the system. Ten or fifteen drops may now be given twice or three times daily. Should the medicine purge too much, this tendency may be controlled by the addition of a little laudanum. When there is little febrile action, and the pain is severe, one of the salts of morphia may be added in full dose to the colchicum, with much comfort to the patient.

Colchicum may also, with great propriety, be associated with any purgative which may from time to time be given to the patient; the wine being preferred, if the medicine is given in the form of a draught, the extract, if in pill. The mixture recommended by Scudamore, of colchicum, magnesia, and sulphate of magnesia, is an excellent purgative in gout.*

When the liver is torpid, the extract of colchicum may be given at bedtime, with from three to five grains of the blue mass, and followed by the laxative draught above alluded to in the morning.

When the urine is very scanty or heavily loaded with uric acid, so as to irritate the kidneys and urinary passages, half a drachm of the bicarbonate of potassa or of soda may be given three or four times a day in carbonic acid water, and the colchicum may be administered at the same time. Sometimes spirit of nitric ether may be advantageously added to the draught, especially when the patient is restless, or otherwise affected with nervous disorder.

Much comfort sometimes accrues from a full dose of Dover's powder at bed-time. It should not, however, be given until the inflammatory and febrile symptoms, if considerable, have abated.

In relation to the *local affection* directly, the less that is done, as a general rule, the better. It was formerly the custom to wrap the part in carded wool or warm flannels, with the view of cherishing the external disease, and preventing retrocession to the stomach or other internal organ; and this was certainly preferable to the repellent plan which some have advised. It probably, however, sometimes occasioned an unnecessary amount of inflammation, and led to ultimate injury of the joint, which might have been avoided. In ordinary cases, the joint may be lightly covered, so as to protect it from cold, and left to the operation of those measures which it may be deemed proper to address to the constitution. Should the inflammation be unusually violent or obstinate, it may not be amiss to apply a few leeches, though this should always be done with caution. Some recommend anodyne and evaporating lotions, with the view of moderately reducing the heat, and relieving the pain; and, when these are excessive, such applications may not be improper, if kept within due bounds. Scudamore's plan, which he found to afford relief in numerous cases, and to do injury in none, was to apply to the inflamed joint a lukewarm mixture, of three parts of camphor water (aqua camphoræ, U. S.) and one of alcohol, by means of linen compresses composed of six or eight folds, or of bread poultices saturated with the liquid. When this was removed, the part was lightly covered with flannel. Some bathe the joint with camphor liniment; others steam it, or employ pediluvia of warm water; and others again apply warm emollient cataplasms, with or without anodyne additions, as the decoction of poppy-heads, hops, camphor,

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* I am in the habit of using the following formula:—R.—Magnesiæ ʒss; Magnes. Sulphat. ℥ss; Vin. Colchic. Rad. ♏xx; Aquæ fluv., vel. Aq. Acid. Carbon. f℥ij. Fiat haustus.

&c. I have sometimes used a warm mixture of tincture of camphor with milk, applied by means of linen compresses, and frequently renewed.

The practice of immersing the feet in cold water cannot be too strongly condemned. It often, no doubt, affords immediate or speedy relief, and sometimes with impunity; but there is always great danger that the disease may seize with fatal violence on some internal part. An instance has been reported to me, upon the best authority, in which a gentleman, anxious for speedy relief, and contrary to the advice of his physician, ordered a bucket of cold water to be taken into his chamber at bed-time, with the view of employing it in this way. In the morning he was found dead in his bed.

Should the joint remain swollen and edematous after convalescence, advantage will often accrue from the application of moderate pressure by means of a flannel or muslin bandage.

When acute gout attacks one of the internal organs, either originally or by retrocession from the exterior, the case must be treated, if of an inflammatory nature, as inflammation of the same part would be treated arising from ordinary causes. Bleeding is here often necessary to save life. The greatest danger now arises from the local disease, and this must be relieved, at whatever cost may be necessary. All other considerations must yield to the present urgency. When the pulse is strong in these cases, there can be no doubt as to the propriety of using the lancet. But sometimes, when the disease attacks the stomach, lungs, or heart, the symptoms are apparently those of great depression; the skin being pale and cool, the pulse small and feeble, and the strength greatly prostrated. This depression may be consequent upon the crippled state of the organs upon which the general functions depend, and not upon real debility; and bleeding may still be indicated as the most efficient means of relief. It should, however, be used with caution. The physician should himself superintend the operation, should keep his fingers on the pulse while the blood is flowing, and close the orifice if he find the circulation becoming feebler. Generally, however, the pulse will rise under the operation, and thus justify the measure.

Local bleeding, fomentations or emollient cataplasms, sinapisms, and blisters, in the vicinity of the inflamed organ, may also be resorted to. But there is one measure of the utmost importance, which is applicable in all cases; and that is the application of irritants to the part from which the gout may have receded, or which may be its ordinary seat when external, in order to invite the disease back to a safe position. If one of the joints of the foot has been affected, pediluvia of hot water, rendered more stimulating by mustard or Cayenne pepper, should be employed; and the application should be continued as long as the patient can conveniently bear it. To render the impression more permanent, the foot-bath may be followed, if necessary, by sinapisms, or other active rubefacients, or by blisters. The necessity of thus attempting to draw the disease to the extremities, in all cases of severe internal gout, cannot be too strongly insisted on.

When the retrocedent disease attacks the stomach in the form of irritation merely, producing, as it sometimes does, violent spasm of that organ, it is necessary to procure relief by means of powerful anodynes, or nervous stimulants. The most effectual is opium, which may be given in doses twice or three times as large as those for ordinary purposes, and still further increased if necessary. Laudanum, or some other liquid preparation of opium should be employed, as more prompt than the solid drug. Its operation may be aided by aromatic spirit of ammonia, sulphuric ether, or musk if necessary. If the stomach reject these medicines they may be administered by enema. A large sinapism should be immediately applied to the epigastrium.

In the treatment of the gouty paroxysm, reference must be had to the constitution and habits of the patient. The remedies which may be employed safely and efficiently in individuals of strong constitutions, and temperate habits, may prove too powerful for the feeble and intemperate. In the latter, purgative tinctures, as the tincture of rhubarb, or the tincture of rhubarb and senna (Warner's gout cordial), may be substituted for, or added to the cathartics ordinarily used. They may in general be appropriately conjoined with magnesia. Colchicum must be employed with more reserve; and greater care should be taken not to cause retrocession by injudicious applications to the external disease. It is often necessary to allow the patient to continue the use of his accustomed beverage, for fear that its sudden abstraction may produce prostration. It should, however, be diminished in quantity.

The diet, during the paroxysm, may be regulated somewhat by the inclinations of the patient. If so much affected by the fever as to be averse to food, he may be confined to gruels or other farinaceous drinks; if he still retain an appetite, he may take solid vegetable substances, with a limited allowance of the lighter and more easily digested kinds of animal food, as milk, oysters, soft boiled eggs, boiled fowl, &c., when there is reason to fear a failure of strength. The previous habits of the patient must here also be taken into view; immoderate eaters, and those who use chiefly high seasoned animal food, not bearing abstinence so well as the temperate, and often rapidly sinking upon the withdrawing of their accustomed support.

During convalescence, care should be taken not to permit too rapid a return to habits of indulgence; the food should continue light, digestible, and unirritating; and the bowels should be kept regularly open.

The *treatment in the interval* is highly important. If the same course of life which induced the disease, or favoured its attack, be continued, there can be little hope of averting future paroxysms, unless at a cost greater than that of the paroxysms themselves; and the patient must surrender himself to that long course of steadily increasing disease, and ultimate death, which has been already described as the general lot of gouty subjects. The complaint cannot safely be averted by any course of known medicinal agents. Various attempts have been made to cure gout by medicines; but they have all proved to be failures. The famous Portland powder, employed, in variously modified forms, from the time of Galen to that of Cullen, has fallen entirely into disuse, in consequence of its fatal effects. Consisting chiefly of tonic or stimulating ingredients, and continued for a great length of time, it probably made the stomach a centre of afflux to the gouty irritation, and thus obviated the external paroxysms; but Cullen states that, in every instance which he knew of its exhibition for the length of time prescribed, the patients were affected with many symptoms of atonic gout, "and all, soon after finishing their course of the medicine, were attacked with apoplexy, asthma, or dropsy, which proved fatal." There is only one safe mode of curing gout; and that is strictly and perseveringly to avoid its causes. If this plan is begun soon after the first developement of the disease, and the constitutional tendencies to it are not irresistible, there may be some hope of escaping it in future, and good reason to expect, that, if not eradicated, it may be very favourably modified, and disarmed in great measure of its violence and danger. Temperance in eating, a rigid abstinence from stimulating drinks, the avoidance of excesses of all kinds, and steady habits of moderate exercise, both on foot and on horseback, so as to keep the digestive organs in a healthy state, are the chief prophylactic measures required. In relation to the diet, it should be light and of easy digestion, not entirely vegetable, but with a smaller proportion of animal food than is usually indulged in, and prepared with little condiment of a stimulant character. (See *Dyspepsia.*) Care must be taken also to keep the bowels in a regular state, to correct any derangement of the hepatic or nephritic function, to obviate any temporary excess of acid in the primæ viæ or in the circulation, and to avoid all the known exciting causes of the paroxysm. For these purposes, an occasional use may be made of mild laxatives, such as rhubarb, magnesia water, Saratoga water, &c., of the antacids, as the bicarbonates of potassa and soda, and of the blue pill as an alterative. But caution is necessary not to get into the habit of depending upon these or any other medicines. Occasionally, when a paroxysm is threatened, it may be averted by a mild cathartic of magnesia, sulphate of magnesia, and wine of colchicum. Among the prophylactic measures, the wearing of flannel next the skin must not be neglected.

Even in those who have long suffered with gouty paroxysms, much may be done, by the prophylactic measures above recommended, towards moderating the force of the disease; though a cure is not to be expected. In elderly persons, who have long been in the habit of indulging in wines, it is scarcely desirable to attempt the breaking up of the habit. There may be some danger that, in removing this artificial support, the natural powers may prove so much decayed as to be insufficient for the sustenance of life; and, in all cases, due attention should be paid to the danger of a sudden change of long established habits.

2. CHRONIC GOUT.—As there is no precise boundary line between this variety of gout and the acute, there is of course no such line in the treatment. It may be said, in general terms, that bleeding from the arm is never necessary or proper, in chronic gout, for external inflammation. Moderate purging may be employed in the paroxysm, when the bowels are disposed to constipation; but substances should be selected which are not likely to debilitate, as rhubarb, aloes, sulphur, or magnesia, which may be given separately, or variously combined, according to the circumstances of the case, and, when there is considerable debility, may be very properly conjoined with aromatics and cordials, as with compound tincture of cardamom, compound spirit of lavender, tincture of rhubarb, or tincture of rhubarb and senna. Colchicum may also be used; but with more caution than in the acute form. Pain and restlessness may be quieted by opiates with or without ipecacuanha, or, if these disagree with the patient, by hyoscyamus, stramonium, or belladonna.

In the remissions of the disease, attention should be paid to the general health, and all the functions kept as free from disorder as possible. It may happen that the internal affections, so common in certain cases of chronic gout, may have so much of the inflammatory character, as to require local depletion by cups or leeches; and even bleeding may sometimes be imperiously demanded to save life, when the disease seizes on one of the vital organs; but this remedy should be employed with much reserve. Revulsion by sinapisms, strong solution of ammonia, oil of turpentine, blisters, &c., as near as may be to the part affected, is here always indicated; while attempts should also be made to invite the disease to its ordinary external position by hot water and the rubefacients.

More frequently, the internal disorders are simply functional, and should be treated as recommended for similar conditions in the more purely nervous variety. An anemic state of the system should be corrected by the simple bitters and chalybeates. If the patient sweat profusely, sulphate of quinia may be used. The debility may even be such as occasionally to call for carbonate of ammonia, and the alcoholic drinks. Arnica and the simple or ammoniated tincture of guaiac may be given, in the hope that, along with their stimulant effects, they may exercise an alterative influence over the disease. Acidity of stomach and other dyspeptic symptoms, constipation or looseness of the bowels, derangement of the hepatic and renal secretions, and, in women, disorder of menstruation, should all receive attention, and be treated as recommended for these conditions when occurring as original affections. Dryness and want of action of the surface should be corrected by frictions, and the use of either the hot or cold bath, according to the reacting powers of the system, the former being preferred when this power is feeble, the latter when it is still considerable. There is little doubt that the famous water-cure may prove useful in some of these cases of chronic gout, when the excitability of the system has not been exhausted. Dr. Seymour recommends benzoate of ammonia or of potassa, in cases in which there is a tendency to the deposition of urate of soda in and about the smaller joints, and thinks he has found deposits of this kind, already in existence, to diminish under its use. (*Med. Gaz.*, May 14, 1847.) Dr. Owen Rees has found lemon juice very useful in similar cases. He employs it in the quantity of one or two fluidounces four or five times a day, combined with small doses of the tincture of chloride of iron; and, in several instances, has thus succeeded in removing deposits which had resisted all other treatment. (*London Lancet*, Dec. 14, 1850, p. 561.) Mr. T. Spencer Wells regards iodide of potassium as the most efficient solvent of urate of soda, and gives it habitually in reference to this property in all varieties of gout except the acute. (See *Am. J. of Med. Sci.*, N. S., xxviii. 178.) In chronic gout, with contractions of the limbs or paralysis, the internal and external use of savine has been advantageously resorted to by practitioners in Germany. (See *J. de Pharm.*, 3e sér., xxii. 58.)

The diet should be that recommended for dyspepsia; and the patient should be extremely careful to clothe himself warmly, with woollen garments next to the skin, and to avoid all unnecessary exposure to cold and wet. He should especially avoid such exposure when not exercising. Sleeping in damp sheets, sitting in a cold damp room, or allowing the feet to remain wet when at rest, are very hazardous for patients with chronic gout. Moderate exercise, in a pure atmosphere, is highly useful. Excessive mental exertion should be avoided with as much care as all other excesses; and the patient should make it a study to cultivate equanimity of mind, and to subdue all tendencies to the indulgence of a fretful, melancholy, or irascible temper. Gouty patients may be assured that they will often greatly prolong their life, as well as render it more comfortable, by an observance of the last-mentioned rule.

Great advantage sometimes accrues, in this variety of gout, from visits to the watering places, and the use of the waters both internally and externally. The hot springs of Virginia are sometimes very beneficial. So also are the sulphur springs of Virginia, Kentucky, and New York. For anemic cases, the chalybeate springs may be recommended, as those of Bedford, Schooley's Mountain, Brandywine, &c. For deranged hepatic secretion and general disorder of digestion, especially with a tendency to constipation, those of Saratoga should be preferred. It is not only the mineral waters that act usefully; but the exercise of the journey, the pure air, and the agreeable relaxation and social pleasures of these resorts. Sea-bathing sometimes also proves beneficial. A residence during the winter in a warm climate is very desirable for chronic gouty patients.

In relation to the *local treatment*, when the disease is seated in one joint, and apparently fixed there, it may be proper, if permanent injury to the joint is threatened, to employ leeching and subsequent blistering; and it may be advisable to repeat the blister several times. But when the disease has any disposition to change its seat, these measures are inappropriate. In the latter case, if any other application is made than a light covering of flannel, it should be something very lenient in its action, as emollient or anodyne cataplasms, mild camphorated lotions, &c. Some have recommended a covering of oiled silk, or thin layers of caoutchouc, so as to confine the perspiration of the part, and thus make a kind of vapour bath about it. Poultices with carbonate of soda are said often to prove beneficial.

Little can be done locally for the removal of the gouty concretions. When the part ulcerates, it should be dressed with poultices, and nature may be somewhat aided by mechanical, and possibly by chemical means, in removing the deposition; but not much can be done in this way, in consequence of the enclosure of the urate within the cells of the areolar tissue. Should gangrenous symptoms present themselves, the yeast poultice, or cataplasms made somewhat stimulating by the addition of creasote, or of some alcoholic liquor, as porter or beer, may be employed.

The nodosities that form upon the tendons and fasciæ will often yield to steady external counter-irritation, by means of the galbanum or ammoniac plaster, one of the turpentines, the ointment of iodine, or repeated blistering.

For the contraction of the muscles, and stiffening of the joints, little more can be done than to immerse the part frequently in warm water, to employ the hot douche occasionally, and to induce the patient, by frequent efforts of his own, to endeavour to regain his command over the movements of the limb.

3. NERVOUS GOUT.—This very diversified disease, which shows itself in almost all parts of the body, and in almost every variety of form, requires an equal diversity of treatment; and the ingenuity of the practitioner is often severely tried, to find out modes of relief which shall at the same time accord with his own sense of propriety, and the incessant demands of his patient. Much, however, can be done towards removing present symptoms, and obtaining a longer or shorter respite from suffering; and sometimes possibly the patient may surmount the disease; but, though life may be prolonged not unfrequently to old age, it is rare that an individual, constitutionally liable to the complaint, does not continue during life to be at times more or less affected by it. I wish the reader to understand that the following observations apply as well to the rheumatic, as to the gouty affection.

One universal rule in these cases is, whenever the faintest disposition is shown by nature to give an external direction to the disease, to encourage her efforts by means calculated to attract irritation to the surface, and especially to the extremities. These have been already sufficiently detailed.

Much may be expected from a judicious use of medicines supposed to have an alterative influence over the disease, such as colchicum, guaiacum, aconite, veratria, arnica, sulphur, iodine, arsenic, &c.; care being taken, in their use, not to allow them materially to disturb the stomach or bowels.

When the system is anemic, as not unfrequently happens, recourse should be had to the preparations of iron, simple bitters, and a nutritious diet.

Whenever the disease is intermittent, no matter what form it may assume, whether that of neuralgic pain, spasm, or functional derangement of some one of the organs, provided there is any approach to regularity in the recurrence of the paroxysm, sulphate of quinia should be freely employed, and will almost always succeed very speedily. The practitioner may often spare his patient long and exquisite suffering, by being upon the watch for this intermittence, and prepared at once to take advantage of it. Not unfrequently, when at first quite irregular, it assumes the regular periodical form under the use of alterative or tonic treatment, and will then yield to the salt of quinia. Twelve, eighteen, or twenty-four grains, should be given between the paroxysms, or even more, if required to bring on the peculiar cerebral phenomena which characterize the action of the medicine.

In the severe neuralgic forms, it often becomes absolutely necessary to have recourse to anodynes. When the attack is of some internal organ, as of the stomach, bowels, heart, &c., opium or some one of its preparations must be given, and often in very large doses, for example, double, triple, or quadruple the ordinary quantity, before relief can be obtained. The opiate may often be usefully combined with colchicum; and I am much in the habit, in these cases, of prescribing a mixture of solution of sulphate of morphia, and the wine of colchicum root. But whenever the urgency of the case will admit of having recourse to some other narcotic, and especially when the pains are external, one of these should be preferred to opium, from the great danger that the patient may be led into the habit of its abuse. The extracts of belladonna, stramonium, and conium, are often very efficient, especially the first. Chloroform may also be usefully employed in some instances.

A very powerful remedy, in the purer neuralgic forms, is the subcarbonate of iron in large doses, say a drachm three or four times a day; and temporary cures will often be effected by the combined use of this medicine and the extract of belladonna. I think that I have seen more cases of pure gouty and rheumatic neuralgia, without inflammation, get well under this combination, than under any other single plan of treatment, except that of quinia in intermittent cases.

In these neuralgic forms, moreover, large doses of sulphate of quinia will often effect cures, even when there is no regular intermission. It will frequently be necessary to push the remedy to the extent of twenty-four or thirty grains in the twenty four hours. This is especially useful when the disease assumes the form of *hemicrania*; but in these, as well as in other cases, it may be advantageously combined with the oil of valerian. The effect of the remedy is not unfrequently to aggravate the headache, for the first day or two, after which the complaint gradually diminishes, and ceases altogether, in three or four days or a week. Hemicrania seldom fails to yield to this treatment.

It is scarcely necessary to follow the disease through the various internal organs; as the functional disorder which it produces in each closely resembles that proceeding from other causes, and requires the same treatment. Thus, when it attacks the stomach in the form of dyspepsia, or of gastrodynia, it must be treated exactly as those affections are usually treated. (See *Diseases of the Stomach*.) The same may be said of the form of colic, which it not unfrequently assumes. Deficient or deranged action of the liver, which is a very common attendant upon this, as well as other forms of gout, requires the occasional use of the mercurial pill or small doses of calomel, care being taken not to carry the remedy so far as to affect the gums. Nitro-muriatic acid is sometimes also very useful in these cases, but should not be given in connexion with the mercurial. Taraxacum and the alkalies now and then prove useful, and may be alternated with the other remedies. Constipation of the bowels should be obviated by laxatives, as rhubarb, sulphur, magnesia, Cheltenham salt, Saratoga water, &c., or by a regulation of the diet, as by the use of bran bread, tomatoes, &c. Nephritic disorder may be treated with the alkaline bicarbonates, and sometimes, when the urine is excessive, by narcotics and astringents, or by terebinthinate remedies. Palpitations, and precordial oppression, will often yield to the aromatic spirit of ammonia, Hoffmann's anodyne, oil of valerian, assafetida, or musk; and dyspnœa, when purely spasmodic, may be treated in the same way.

In relation to all these affections, and others of analogous character, the general rules already given must be borne in mind, of relieving violent pains by opiates or other narcotics, of endeavouring to give an external direction to the disease by hot fomentations, rubefacients, blisters, &c., and of addressing remedies to the constitution with the view of subverting the disease, as colchicum, quinia, &c. Not unfrequently, also, even when there is no reason to believe that there is any inflammation, leeching in the neighbourhood of the part, or even the loss of blood from the arm, will afford great relief in painful internal affections. When the disease seizes upon the head, these last remedies are especially useful. Gouty or rheumatic headache often yields very happily to a few leeches or cups to the temples, or nape of the neck. But bleeding must always be used with some reserve; as, though it may afford relief, it does not eradicate the tendency, and, too frequently repeated, may produce an anemic condition, favourable to the perseverance of the disease. Another important fact to be borne in mind is, that, in many of these cases of disordered function and neuralgic pains, the real cause is an attack of the disease in the ligaments or internal membranes of the spinal column, producing irritation in the spinal marrow, and consequently derangement in all its dependent functions. In such cases, the remedies must be addressed especially to the spine.

Besides the local measures already referred to, various others may be used with much temporary benefit, in the more painful forms of the disease. Emollient, anodyne, and rubefacient embrocations or cataplasms; frictions with aconite, veratria, and colchicum, in ointment, or strong spirituous solution; plasters of belladonna and stramonium; morphia sprinkled on the skin denuded of the cuticle; chloroform in poultices, or applied by means of linen moistened with it, and protected from evaporation by a covering of oiled silk; have all been employed, and with excellent apparent results; but, in this affection, it is not always possible to determine how much is owing to the peculiar virtues of the remedy, how much to the mere process employed in its application, and how much to the mind of the patient. I have repeatedly known gentle and continued friction with the hand to dissipate the pain entirely for a time; and nothing is more common than for the same effect to follow any strong mental movement, whether emotional or intellectual.

In this variety of gout, it is especially necessary to invigorate the constitution; for which purpose moderate exercise, pure air, a nutritious but easily digested and unstimulating diet, the pleasures of agreeable social intercourse, and the avoidance of all excesses, whether mental or physical, are the chief measures to be relied on. More even than in chronic gout, will advantage accrue from travelling, frequenting the watering places, &c. Any plan of life, which, while it favours health in general, places the system of the patient under entirely new influences, will often prove of the greatest benefit, and sometimes completely renovate the constitution. Hence the advantages of a foreign tour and residence. Hence the wonderful revolution sometimes effected in the health by a change of fortune, which reduces the patient from the luxuries, indolence, and self-indulgences of wealth, to the necessity of daily exertion for a livelihood. Hence, probably, also, in part, the advantage which has frequently accrued, in such cases, from the famous water-cure.

CLASS III.

LOCAL DISEASES.

This is much the largest of the three classes in which diseases are arranged in the present treatise. It embraces all those which have their seat primarily or essentially in any one organ, tissue, or function. The local affection is often accompanied with constitutional symptoms; but these are secondary, as in the phlegmasiæ, in which the fever depends upon the inflammation. It is true that, among the following diseases, are also many which are results of constitutional derangement; but, in these instances, the local affection is so striking and important as chiefly to engage attention, and always to have ranked among diseases, with a distinct title; while the constitutional disorder, from which it may have sprung, is often concealed and unknown. Such are the local tuberculous affections, many instances of dropsy, and not a few cutaneous eruptions.

I have preferred the several functions as the basis of arrangement in this class, to the regions of the body; because it often happens that a particular disease, though confined to one function, overleaps the region, and may in fact occupy several regions, as dropsy occurring at the same time in the chest, abdomen, and external areolar tissue. In the order of the functions, I begin with that which nature has placed first and lowest in the scale, and follow her course through the remainder. Pursuant to this plan, the diseases connected with the digestive system come first in order; then those of the absorbent system; and afterwards successively those of the respiratory, circulatory, secretory, and nervous. Diseases of the reproductive system, so far as they peculiarly belong to it, come generally under the care of the surgeon or obstetrician.

In each group of diseases, those which consist in inflammation of the parts concerned are first treated of; because they are in general better understood and more easily recognized, and consequently, when known, serve as standards of comparison for the more obscure functional affections.

SECTION I.

DISEASES OF THE DIGESTIVE SYSTEM.

These are most conveniently distributed into minor groups, connected severally with distinct portions of the digestive tube. The *first* embraces diseases of the mouth, the *second* those of the fauces, pharynx, and œsophagus, the *third* those of the stomach, and the *fourth* those of the bowels. But, as there are several affections which occupy the stomach and bowels jointly, a *fifth* group is made, including such diseases, together with those of the peritoneum, which may be considered as an appendage.

SUBSECTION I.

DISEASES OF THE MOUTH.

In this subdivision are included, 1. the different forms of inflammation of the mucous membrane of the mouth; 2. inflammation of the tongue; 3. morbid states of dentition; and 4. diseases of the teeth, under the general heads of toothache and falling of the teeth.

Article I.

INFLAMMATION OF THE MOUTH, or STOMATITIS.

The term stomatitis (from στομα, mouth) is applied to inflammation of the mucous membrane of the mouth. The disease appears under various forms. The inflammation may be diffused equably over portions or the whole of the membrane, or may occupy chiefly or exclusively the mucous follicles. When diffused, it may present no peculiar secretory product, or may cover the surface with a consistent curd-like, or a pseudo-membranous exudation. It may be attended with eruption, ulceration, or gangrene, and receive from each of these attendants the character of a distinct variety. In fine, it may be peculiar from the nature of the cause, as when it accompanies scurvy, or is the result of mercurial action. It will be most convenient to treat of each of these forms separately.

1. Common Diffused Inflammation.—This appears in reddened somewhat elevated patches, or occupies large portions of the surface, sometimes extending apparently over the whole mouth. In some cases, it is superficial, with little or no swelling, and may be designated as *erythematous;* in others, it occupies the whole thickness of the membrane, extending sometimes to the submucous tissue, and even to neighbouring structures, as the sublingual and submaxillary glands, and the absorbent glands of the neck, and occasions considerable tumefaction in all these parts. In the erythematous form, it is characterized by redness, a sense of heat, and sometimes considerable tenderness, but is not usually attended with acute pain; when deeper in the tissue, it is often very painful. Portions of the epithelium sometimes become opaque, giving an appearance of whiteness in streaks or patches. Occasionally this coating is elevated in blisters, or even detached like the cuticle from the skin in scalds. Superficial ulcerations not unfrequently occur, which may spread over considerable portions of the membrane. In certain states of the constitution, the ulcerative tendency is very strong, and deep and extensive sores occur, which are sometimes attended with gangrene. There is often a copious flow of saliva; though, in some instances, this secretion, as well as that of the mucous follicles, is checked, and the mouth is clammy or dry. The sense of taste is usually more or less impaired, and speech and mastication are often difficult and painful. When the tongue is affected, its surface is in general at first covered with a whitish fur, through which the red and swollen follicles may often be seen projecting. The fur sometimes breaks off, leaving the surface red, smooth, and glossy, with here and there prominent follicles, and very sensitive to the contact of even mild substances; or the surface may be dry, hard, and gashed with painful fissures. When the gums are involved, they swell, and rise up between the teeth, around the neck of which they not unfrequently ulcerate. In some rare instances, this ulceration is very obstinate, and does not cease until it has extended into the socket, and destroyed altogether the connexions of the teeth, which become loosened and fall out, after which the gum will heal. There is a mild variety of stomatitis, which may be denominated catarrhal, attended with a copious secretion of mucus and saliva, with a furred tongue, and deficient taste, but with little redness, swelling, or pain. This is sometimes mistaken for disease of the stomach, especially when it becomes chronic; but may be distinguished by the undiminished powers of digestion, and the absence of direct gastric symptoms. Upon careful observation, it will be found that the discharged liquid pro-

ceeds from the mouth, and does not rise from the stomach either by eructation or vomiting. A mistake of this affection for gastrorrhœa would be very inconvenient in practice. Ordinary stomatitis is seldom so violent as to induce symptomatic fever.

Causes.—The form of inflammation of the mouth, above described, is more frequently a complication of other diseases than an original affection. When of the latter character, it is generally caused by the direct action of irritant bodies, as by scalding drinks, acrid or corrosive substances taken into the mouth, or unhealthy secretions from decayed teeth. The sharp edges or spiculа of a broken tooth sometimes give rise to much inflammation, and even deep and obstinate ulcers, especially of the tongue. The tartar which collects about the neck of the teeth often keeps up a state of chronic inflammation of the gum, which sometimes ends in destructive ulceration. Stomatitis may also result from the reaction which follows the long continued contact of very cold substances, such as ice, with the interior of the mouth. It sometimes proceeds from the propagation of inflammation from the fauces, and is a frequent consequence of gastric irritation, produced by sour or acrid matter in the stomach. Drunkards seem peculiarly predisposed to it. Of the constitutional causes none are so frequent as the state of fever, which, whatever may be its particular character, is very apt to affect the mouth, and not unfrequently occasions inflammation.

Treatment.—In the acute stage, little treatment is required. In some very severe cases, in which the neighbouring parts are involved, leeches beneath the jaw or over the parotid may be advisable. But, in general, cooling and demulcent liquids locally, magnesia or one of the saline cathartics internally, with a soft and spare diet, from which meat is excluded, constitute all that is requisite. Where the inflammation results from some corrosive substance taken into the mouth, almond oil spread over the surface will be found a useful application. In the latter stages, and in chronic cases, astringent washes, such as weak solutions of acetate of lead, sulphate of zinc, and alum may be advantageously applied; and, if ulcers exist which are indisposed to heal, their surface may be touched with a strong solution of sulphate of zinc, sulphate of copper, or nitrate of silver, care being taken that the application do not extend beyond the limits of the ulcer. In the chronic catarrhal variety of stomatitis, Dr. Pfeifer recommends a mouth-wash consisting of a grain or two of corrosive sublimate dissolved in a pint of water. In cases accompanied with gangrene, washes of chloride of soda, chloride of lime, or aqueous solution of creasote may be used. Should the inflammation depend upon the condition of the teeth, whether upon sharp edges or points wounding the adjacent parts, or upon acrid secretions, or the deposition of tartar about the neck of the tooth, care should be taken to correct the evil.

2. Diffused Inflammation with Curdy Exudation.—*Thrush.*—*Infantile Sore-mouth.*—*Muguet, of the French writers.*—As this affection, though it may occur at all ages, is far more common in early infancy than at any other period, it is here described as it appears in the infant. A superficial or erythematic inflammation is first observed, which, in two or three days, or even in a shorter time, presents small whitish points at the angles of the mouth, or on the inside of the lower lip. These increase in number, and coalesce, forming patches, consisting of a whitish curd-like matter; and the affection gradually extends to the tongue, the roof of the mouth, and the inside of the cheeks, and not unfrequently reaches the fauces and even pharynx. The exudation is sometimes thick and covers the whole surface, but is more commonly in irregularly scattered patches and points. It occasionally assumes a yellowish or

brownish colour, and the latter is considered as an unfavourable sign. After a time it falls off; but its place is supplied by a new exudation; and this change may occur several times. The mouth of the infant is hot, and the nipple of the nurse not unfrequently excoriated. When the throat is affected, the voice is apt to be hoarse. The complaint is sometimes preceded, and is often attended by diarrhœa, with flatus and colicky pains; and the stools are frequently green and slimy. The child also vomits green matter, smelling strongly sour; and the breath often has an acid odour. Redness about the anus is not uncommon, dependent probably on the acrid discharges. It is asserted that masses of the caseous matter are sometimes found in the stools, showing that the affection has extended to the bowels. The child is often somnolent, especially in the worst cases. The affection is sometimes entirely local, but, in the greater number of cases, is attended with some acceleration of the pulse and febrile heat. As it usually occurs, it is without danger, but, when the stomach and bowels become involved, in children of bad habit of body, it often proves fatal. Generally, however, in fatal cases, the affection of the mouth is a mere complication of some independent disease, which is the cause of death. The complaint is of no certain duration, sometimes, when merely local, terminating favourably in a few days, sometimes becoming chronic, and lasting for several weeks. It often returns after apparent cure, and this may happen repeatedly during a period of several months.

It appears from dissection that the disease sometimes extends into the œsophagus, as far as the cardiac orifice, presenting the same appearances as in the mouth. Patches of the exudation have even been observed in the stomach and small intestines; and a case is on record in which it was found lining the lower end of the ileum, and the whole of the large intestines as far as the anus. (*Revue Méd.*, Juin, 1830.) But this is comparatively a rare event; and the gastric and intestinal irritation which so often attends the disease, does not seem to be the result of its extension, in an unaltered form, to the alimentary canal. In the matter thrown out upon the inflamed surface, Dr. Gruby, of Vienna, and Dr. Berg, of Stockholm, discovered, by means of the microscope, a cryptogamic growth analogous in structure to the lower order of fungi, to which the disease has been ascribed. It is true that, under the microscope, the curdy matter of thrush is seen to consist mainly of thickened epithelial cells, mingled with great numbers of minute cryptogamic sporules or seeds, from the midst of clusters of which long thread-like, jointed, and branching plants arise, intertwining among one another; but the question is not determined whether the vegetation is the origin of the complaint, or whether this consists of an inflammatory exudation, which simply affords a nidus for the growth and propagation of the fungus. I confess that I am inclined to the latter opinion.

Though most common among very young infants, the disease is not confined to any age and not unfrequently attacks adults. But, in the latter case, it is almost always a consequence of other diseases, especially of long continued affections in which the alimentary canal is primarily or secondarily involved. It is not uncommon in the last stage of phthisis; and, whenever it occurs in the chronic complaints of adults, must be considered as an unfavourable sign, indicating for the most part the breaking up of the constitution.

Causes.—The causes of this variety of stomatitis are not always evident. It is very apt to occur in situations, such as foundling hospitals, where the air is impure and the diet unwholesome. Children prematurely born, or brought up by the hand, or nursed by unhealthy women, are more liable to be affected than others. In fact, whatever tends to impair the health and vigour of the infant, to induce acidity of stomach or other gastric or intestinal disorder, disposes to its occurrence. Yet it often comes on, under apparently the most favourable circumstances, and in healthy well-fed children, and must be ascribed to some inappreciable modification of the infantile constitution. There is no reason to consider it contagious, and it is independent of vicissitudes of temperature. It seems occasionally to assume something like an epidemic character, being more than usually prevalent in certain families, or certain neighbourhoods, without any obvious cause.

Treatment.—In cases which are purely local, little or no constitutional treatment is required. Costiveness should be obviated by an occasional dose of castor oil, or of magnesia; and fever by small doses of the neutral mixture, or, if attended with acidity, by one of the alkaline carbonates. Should diarrhœa occur, with green stools, magnesia may be given alone or combined with rhubarb; or, if the child be too weak for purgatives, prepared chalk or oyster-shell may be substituted; or the two may be alternated. Whichever of these antacids is used, it may be advantageously administered in some aromatic water, as that of spearmint, peppermint, or fennel, and combined with small portions of laudanum.[*] Emollient enemata, and poultices over the abdomen, may be employed to relieve the intestinal irritation. Dr. Dewees recommends a fluidrachm of fresh butter, melted and washed by means of hot water, to be given three times daily, when the discharges are small and bloody. Vomiting may be treated with lime-water and milk, emollient poultices, fomentations, or rubefacients to the epigastrium, or, if these fail, by anodyne enemata. It may sometimes be advisable, though very rarely, to apply a few leeches to the epigastrium or anus. In cases of great debility, infusion of bark, or sulphate of quinia in solution, with a little laudanum or paregoric elixir, may be resorted to. The best diet is the milk of the mother if healthy, or of a healthy nurse, who should avoid acescent food. In cases, however, attended with much gastric or intestinal irritation, it may be proper to substitute, wholly or in part, drinks of farinaceous or demulcent substances, such as barley, arrow-root, and gum arabic, prepared with little or no sugar. In debilitated cases, rich broths, without fatty matter, should be given. Care should always be taken to keep the apartment well ventilated, and that the infant breathes a pure air.

In relation to local applications, some writers recommend only demulcent liquids in the early stages, such as infusion of flaxseed or marsh-mallow, solution of gum arabic, or almond emulsion; while others approve of the use of borax, either dissolved in honey, or in the form of powder mixed with sugar. One part of borax to eight or ten of loaf sugar are the proportions usually adopted; but Dr. Dewees directs equal parts. A small pinch of the mixture should be placed on the tongue, and the infant allowed to spread it over the mouth. When the irritation is severe, Bateman recommends an emollient combination suggested by Van Swieten, consisting of cream, yolk of eggs, and syrup of poppies. In the advanced stages, when the disease is somewhat obstinate, a solution of sulphate of zinc in the proportion of two grains or more to a fluidounce of water, with a little honey, will often be found useful. In the same stage, rose water acidulated with muriatic or sulphuric acid, and solutions of alum, chlorinated soda, and nitrate of silver, are also occasionally used.[†] These applications should be made carefully, from four to eight times a day, with a camel's hair pencil, or a pencil of lint, and the greatest caution should be observed not to irritate the inflamed parts by rubbing them. No attempts should ever be made to remove the white exudation forcibly. Dr. W. Jenner finds the application of a solution of sulphite of soda, in the proportion of a drachm to an ounce of water, to effect a speedy cure of the disease. He ascribes its beneficial effect to the destructive influence of the sulphurous acid, liberated by the acids of the secretions of the mouth, upon the parasitic fungus on which he supposes the disease to depend. (*Lond. Med. Times & Gaz.*, vii. 181.)

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[*] ℞.—Magnesiæ ʒss; Rhei pulv. gr. xv. Misce et divid. in chart. no. vj. S. One for a dose. ℞.—Magnesiæ ℈ij; Acaciæ pulv., Sacch. alb. āā ʒj; Aq. Menth. P., Aq. fluv. āā f℥j. Misce. S. A teaspoonful, every two or three hours till it operates. ℞.—Cretæ ppt. vel Testæ ppt. ʒj; Tinct. Opii ♏iv; Acaciæ pulv., Sacch. alb. āā ʒj; Aq. Cinnam. f℥ss; Aq. fluv. f℥iss. Misce. S. A teaspoonful every three or four hours, in diarrhœa.

[†] ℞.—Acid. Sulphuric. Dilut., vel Acid. Muriat. fʒj; Syrup. vel Mellis f℥j; Aq. Rosæ f℥ij. Misce. ℞.—Alumin. gr. x; Mellis f℥ss; Aq. Rosæ f℥iss. Misce. ℞.—Liq. Sodæ

In adults, the same local applications may be made, and the mouth may be frequently washed with cold water, or solution of acetate of lead.

3. FOLLICULAR INFLAMMATION.—The mucous follicles may be affected with inflammation independently of the neighbouring parts, or in connexion with them. In the latter case, they are distinguished as small red eminences projecting beyond the general reddened surface of the membrane, and are particularly observable upon the tongue and soft palate. When independently inflamed, they are, according to M. Billard, the source of those small round or oval ulcers, which are so common in the mouth, and have long been known by the name of *aphthæ*. That these muciparous glands are occasionally the seat of aphthous ulcerations there can be no doubt; but a much more common source of them is the affection which will be noticed in the next section. As described by M. Billard, the inflamed follicles may be sometimes felt by the finger before they can be clearly distinguished by the eye. When first distinctly visible they are in the form of minute, hard, round, whitish eminences, surrounded by a circle of redness. If the inflammation should not subside, the little tumours soften in the centre and ulcerate, and the surface of the ulcers is covered with a whitish adhering matter. These ulcers are usually distinct; but, when numerous follicles in the same vicinity are inflamed, they become confluent, and form a continuous whitish ulcerated surface of considerable extent. This affection, according to M. Billard, is apt to appear at the period of dentition; but it sometimes also attacks adults, and is asserted to occur in early infancy, when it is usually confounded with the thrush. In its confluent form, it is said frequently to attend the last stages of the exanthematous fevers, and of various chronic complaints, such as phthisis, cancer, and chronic inflammation of the abdominal viscera. The treatment is not different from that of the following variety of stomatitis.

4. ERUPTIVE OR VESICULAR INFLAMMATION.—*Aphthæ.*—The term *aphthæ* was employed by the ancients to signify various inflammatory affections of the mucous membrane of the mouth. Willan proposed to restrict it to a peculiar vesicular eruption upon the membrane, but committed the error of confounding with this affection the thrush of early infancy, which, in general, as already described, is attended neither with eruption nor ulceration. The two complaints are quite distinct, and should not be similarly designated. The term *thrush*, in this work, is applied to the infantile sore-mouth already treated of; while *aphthæ*, in compliance with very general usage, is extended to all those small ulcers, with whitish surfaces, which so frequently appear in the mouth, whatever may be their origin. Their most frequent source is probably the vesicular eruption, which constitutes the subject of this section. The vesicle is small, oval or roundish, white or pearl-coloured, and consists

Chlorinat. fʒiss; Aquæ Rosæ f℥iss: Misce. ℞.—Argenti Nitrat. gr. j; Aq. Destillat. f℥j. Misce. Some recommend a much stronger solution of nitrate of silver, containing from five to eight grains of the salt to a fluidounce of distilled water; but such a solution should not be applied oftener than once or twice a day.

of a transparent serous fluid under the elevated epithelium. In a few days, the epithelium breaks, the serum escapes, and a small ulcer forms, more or less painful, with a whitish bottom, and usually a red circle of inflammation around it. The vesicles are sometimes distinct and scattered, sometimes numerous and confluent. The distinct variety, though painful, is a light affection, continuing in general only a few days or a week, and is usually confined to the mouth. It produces little or no constitutional disorder, though it may be associated with fever and gastric irritation as an effect. It attacks equally children and adults; but is said not to be very common in early infancy. In adults it is frequently occasioned by the irritation of decayed teeth. The confluent variety is much more severe and obstinate. This frequently extends into the fauces and pharynx, and is even said to reach the intestinal canal, though it may be doubted whether the affection of the stomach and bowels is identical with that of the mouth. When it occupies the fauces, it renders deglutition painful. It is sometimes attended with gastric uneasiness, vomiting, intestinal pains, and diarrhœa. Fever occasionally precedes it, and moderates without entirely ceasing upon the appearance of the eruption. The fever sometimes assumes the typhoid character. The complaint is not common. It occurs most frequently in adults, and is said to attack preferably women in childbed. It may continue for several weeks, and sometimes proves fatal.

Treatment.—In ordinary cases, no general treatment is required. Magnesia may be given to correct acidity, and the diet regulated by the state of the stomach. In the severer cases, fever should be obviated by refrigerant cathartics and diaphoretics, and by a liquid farinaceous or demulcent diet. When the disease attacks the fauces or pharynx, occasions painful swallowing, and is attended with much fever and a strong pulse, general bleeding may become necessary, and subsequently the application of leeches to the throat. Diarrhœa must be counteracted by the usual remedies calculated to relieve intestinal irritation, among which may be mentioned as especially useful, emollient applications to the abdomen, and the warm bath. When the fever assumes the typhoid form, a tonic and supporting treatment may be required.

In the early stage, the local treatment should consist of demulcent applications, as flaxseed tea, mucilage of gum arabic, or almond emulsion, with or without a little laudanum, or some preparation of morphia. But, after the inflammation has somewhat subsided, and ulcers are left indisposed to heal, astringent washes may be resorted to. Solutions of acetate of lead, sulphate of zinc, and alum; water acidulated with sulphuric or muriatic acid, and sweetened with the honey of roses; and various vegetable astringent and tonic infusions have been recommended. The author usually employs a strong solution of sulphate of zinc, in the proportion of 15 or 20 grains to the fluidounce of water, which he applies by means of a camel's hair pencil exclusively to the ulcers, with the almost uniform effect of disposing them to heal; and, even in the eruptive stage, this application will often be found to effect an almost immediate cure. Equally effectual are probably the nitrate of silver and sulphate of copper, applied to the ulcers, either in strong solution or in the solid form.

5. ULCERATIVE INFLAMMATION.—*Ulcerative Stomatitis.*—*Cancrum Oris.*—*Canker.*—Any inflammation of the mouth may be attended with ulceration; but the complaint here referred to is essentially ulcerative, appearing in this form at the commencement, and presenting characters which entitle it to rank as a distinct affection. Dr. Symonds considers *cancrum oris* as a synonyme of *gangrene of the mouth;* but such is not the ordinary application of the term.

It is true that the ulcers, usually called canker, may, in constitutions predisposed to gangrene, terminate in that affection, but in the great majority of cases they do not appear to have such a tendency, and are a comparatively innocent disease.

The complaint usually makes its appearance in the gums or inside of the cheeks or lips; though it may occur in any part of the mouth, or in the fauces. When first noticed it is in the form of an ulcer, often of considerable size, with a yellowish-white or grayish surface, and an inflamed border. The neighbouring parts are also inflamed and swollen, and, when the ulcer is in the cheek or lips, the tumefaction is observed externally, the cheek of the side affected being red, shining, and prominent. The swelling in the mouth is sometimes so considerable as to render an examination of the sore difficult. There is a very copious flow of saliva; and the breath is very offensive, though the fetor is distinct from that of gangrene. The ulcer is generally painful, and is usually attended with fever and constipation. It may continue for weeks or even months without very serious consequences; though, when upon the gums, it sometimes lays bare the alveolar processes. I have never known it to penetrate through the cheek, nor to end fatally; though what might be the ultimate consequences of continued neglect I am unable to say. I have always found it to yield to treatment.

Patches of *pseudo-membranous inflammation* now and then occur in the mouth, bearing much resemblance to the ulcerative affection above described, and possibly constituting, in many instances, its first stage. The patches covered with the plastic effusion are whitish at first, then grayish, and sometimes at last livid or blackish. In consequence of the inflammation around them, they appear set in the membrane, and hence bear a close resemblance to ulcers. They end either by a gradual absorption or separation of the pseudo-membranous matter, or by a destruction of a portion of the mucous tissue, when an ulcer results.

The causes of cancrum oris are obscure. It generally occurs in children from two to six years old; has been ascribed to a debilitated habit of body, arising from deficient or improper food, bad air, want of cleanliness, &c.; and is said to prevail most among the poor. I have seen it, however, in children otherwise apparently healthy, well fed, and well provided for in all respects.

Treatment.—From two to six grains of calomel may be given at the commencement, either associated with some other cathartic, such as rhubarb or jalap, in order to insure its operation upon the bowels, or followed, should it not operate in six or eight hours, by a dose of castor oil. The bowels may afterwards be kept open by the occasional administration of castor oil, magnesia or its carbonate, or the sulphate of magnesia; small doses of the neutral mixture, or of antimonial wine should be given when the fever is considerable; and, if the breath should be sour, a few grains of the bicarbonate of soda in carbonic acid water, repeated three or four times a day, will be found useful. In protracted cases, attended with debility, it may be advisable to have recourse to the mineral acids, and to infusion of bark or sulphate of quinia. Iodide of potassium often operates very favourably. In the febrile state, the diet should consist exclusively of farinaceous liquids. In the absence of fever, milk may be allowed; and, in cases of debility, animal broth, jelly, &c. Sour and acescent food should be avoided.

But the local treatment is chiefly to be relied on. Various applications have been recommended. Among these are mouth-washes of tincture of myrrh with Peruvian bark, dilute mineral acids with honey, and solution of alum. I have found nothing so useful as a solution of sulphate of zinc, in the proportion of fifteen or twenty grains to the fluidounce of water, applied twice or three times a day to the ulcer, by means of a camel's hair pencil, and continued until the yellowish-white exudation is removed, and the surface assumes a reddish hue. With this application I have in no instance failed to effect a cure. It is highly probable that strong solutions of sulphate of copper or nitrate of silver, which have been recommended, would prove equally effectual. Nitrate of copper and the diluted nitric acid of the pharmacopœia have also been found useful. The pseudo-membranous patches above described may be treated in the same manner.

Dr. T. H. Babington, of Coleraine, Ireland, has employed chlorate of potassa, internally, in this complaint, in thirty cases, with speedy and uniform success. After administering an aperient of rhubarb and magnesia, he gives four grains of the chlorate, dissolved in sweetened water, every four hours; frequently washing the mouth in a warm weak solution of chloride of soda. (*Dub. Quart. Journ. of Med. Sci.*, xv. 236.)

6. SORE-MOUTH OF NURSING-WOMEN.—There is a form of ulcerative inflammation of the mouth, peculiar to women while suckling, or in the advanced stage of pregnancy. It was described by Dr. E. Hale, in a communication to the Massachusetts Medical Society, published in 1830, and subsequently by Dr. F. F. Backus in the *American Journal of the Medical Sciences* for January, 1841. It comes on with a loss of taste, and a sensation described as similar to that produced by scalding liquids, and is sometimes very sudden in its attack. According to Dr. Hale, one or more minute, hard, painful tumours occur, at the beginning of the complaint, on the side of the tongue, which after a time ulcerate, producing very painful sores, with hard elevated borders, and a circle of inflammation around them. According to Dr. Backus, the ulcers often do not make their appearance until a considerable time after the commencement of the inflammation. They gradually increase in size, while others appear upon the tongue and inside of the cheeks, and the inflammation sometimes extends over the whole mouth. The surface is red and extremely tender and painful, so that no drinks or food can be borne but those of the blandest character. The tongue is not coated, but is red and smooth, and there is a copious flow of saliva. The disease is at first local, being unattended with fever or loss of appetite; but, if not arrested, it is apt to extend to the fauces and œsophagus; the stomach and bowels become irritated; diarrhœa often takes place; and the patient falls into a state of great debility and emaciation, which sometimes terminates in death. Dr. W. H. Byford treats of three varieties of the disease; 1. a diffused superficial inflammation of the buccal mucous membrane; 2. a vesicular eruption which may be superadded to the first variety; and 3. an ulcerative affection similar to that above described. (*Am. Journ. of Med. Sci.*, N. S., xxv. 393.) The cause is some influence exerted on the system by nursing, or by the advanced state of pregnancy; as persons are not affected under other circumstances, and the disease always gives way upon the weaning of the child. What is the nature, however, of this influence is unknown. It does not seem to be connected with any pre-existing condition of health, or character of constitution. The complaint is apt to recur in subsequent nursings; and Dr. Hale thinks that, when pregnant women are attacked, it is in consequence of a predisposition acquired from having had the disease while nursing on a previous occasion. It appears to be especially prevalent in particular localities.

The most efficient remedies are said to be tonics and laxatives. Dr. Hale gave sulphate of quinia or infusion of Peruvian bark, serpentaria, ale or porter, and Seidlitz powders or rhubarb; Dr. Backus, a combination of carbonate of iron, rhubarb, aloes, and ipecacuanha, in the form of pills. Dr. Byford recommends cod-liver oil. The diet should be of milk and farinaceous substances. As local applications, mild astringent infusions, or a solution of nitrate of silver are recommended. Should these remedies fail, the child should be removed from the breast; and a cure then speedily takes place. Since the publication of the first edition of this work, a note has appeared in the *New York Journal of Medicine* (x. 372), from Dr. H. D. Holt, in which the writer states that the disease has invariably yielded, under his observation, in less than forty-eight hours, to iodide of potassium, given in the dose of five grains three times a-day. Dr. R. Wilcox has met with uniform success from the decoction of *smart-weed* (*Polygonum punctatum* of Elliot), made by boiling an ounce of the dried leaves and tops in a pint of water for twenty minutes, and applied to the affected part every hour through the day. (*Am. Journ. of Med. Sci.*, N. S., xvi. 248.) Dr. J. Y. Ware, of Massachusetts, has found the compound mixture of iron (U. S. Ph.), given internally in doses of a tablespoonful three times a-day, and a solution of nitrate of silver containing two grains to the fluidounce, used as a gargle, to be infallible. (*Ibid.*, xviii. 290.) Dr. M. L. Knapp, formerly professor of Materia Medica in the University of Iowa, considers this disease as essentially scorbutic; and has treated cases on this principle successfully which have come under his notice; but the affection, as described by Drs. Hale and Backus, has not the peculiar features of scurvy, and differs probably from that noticed by Dr. Knapp. (See *New York Journ. of Med.*, N. S., vii. 206.)

7. GANGRENOUS INFLAMMATION.—*Gangræna Oris.—Sloughing Phagedæna of the Mouth.—Necrosis Infantilis.*—Gangrene may originate in the mouth, as elsewhere, from inflammation, in consequence either of the violence of the affection or of constitutional predisposition; but the complaint which it is intended to designate by the above title is one of peculiar character, occurring under peculiar circumstances, and presenting peculiar phenomena. Indeed, it is an unsettled point, whether it has in general any dependence upon inflammation. By many the gangrene is considered as an original affection, and the inflammation which sometimes attends it rather as an effect than a cause. The probability is that it depends upon a peculiar morbid condition of system, which is sometimes capable of immediately producing it, but more frequently acts as a predisposition merely; inflammation or ulceration of whatever kind serving as the exciting cause, which calls this predisposition into action. In this way, the ulcer described in a previous section as canker of the mouth may sometimes be the first stage of the true *gangræna oris.*

Gangrene of the mouth occurs usually in children between the periods of the first and second dentition, though accounts are not wanting of its occasional occurrence also in adults. It is not often seen by the practitioner in its earliest stages. When it first attracts notice, it commonly exhibits a whitish or ash-coloured eschar, situated upon the gums, most frequently between the lower incisors, though it may occur in any part of the mouth or fauces, and is often seated on the inside of one of the cheeks. This ulcer is sometimes, though not generally, preceded by a slight degree of inflammatory redness and swelling. When on the inside of the cheek, it is usually accompanied with considerable swelling, so that the cheek appears externally quite prominent; and this is sometimes the first mark of the disease which attracts notice. The exterior surface of the cheek is for the most part polished, and whiter than in health. In this stage the child suffers little or no pain; nor are any striking constitutional phenomena presented. There is often an air of languor and weakness about the little patient; but the functions are apparently regular, and the usual avocations or amusements are not interrupted. There are seldom any signs of fever. As the complaint advances, the slough spreads, the saliva flows copiously, and the breath becomes excessively fetid. The disease penetrates to the bony structure, necrosis of the alveolar processes takes place, and the teeth are loosened and fall out, with portions of their bony sockets. An acrid fluid is poured out by the sloughing and ulcerating surface, which inflames and excoriates the inner surface of the mouth, and, by thus over-exciting the enfeebled structure, gives rise to new centres of mortification. Upon the swollen cheek externally, a pale ash-coloured spot sometimes makes its appearance, which becomes livid or black, and spreads rapidly, till much of the cheek is destroyed; and portions of the upper jaw, and even the palatal and ethmoidal bones, are said to have been, in some instances, involved in the mortification; but death usually takes place before the disease has had time to effect so much local mischief. In the progress of the gangrene, a febrile action sets in, probably occasioned, in part, by inflammation of the mouth and throat, resulting from the sloughs and the acrid discharges, and, in part, by the putrid matter swallowed by the patient. The pulse is frequent and feeble, and the child very restless and morbidly wakeful. There is often, in the advanced stages, an almost total inability to take food, which tends to increase the debility. An exhausting diarrhœa, moreover, supervenes towards the close of the disorder. Death is preceded by cold extremities, and the other customary evidences of extreme exhaustion.

The disease seldom occurs after the period of the second dentition. It is most apt to attack children of debilitated constitutions, resulting from habitual exposure to a vitiated air, and the use of unwholesome or insufficient food. Hence, it is most prevalent in miasmatic districts, and in public establishments where children are crowded together. It is a frequent sequela of other diseases, especially of intermittent and remittent fever, and the exanthemata. Mercury has sometimes been accused of producing it, though generally upon insufficient grounds. It is possible that the mercurial sore-mouth may sometimes have degenerated into this complaint, in persons predisposed to it. The opinion is highly probable, which ascribes the constitutional predisposition to the disease to a depraved condition of the blood. It is not unfrequently complicated with pneumonia, which greatly increases the danger. Of twenty-one fatal cases, Rilliet and Barthez found this complication in nineteen. (*Traité des Maladies des Enfants*, ii. 152.)

Treatment.—The disease, when taken in hand in an early stage, is almost always curable; but, after considerable sloughing, especially of the cheek, is generally fatal. The remedies addressed to the constitution are those calculated to support the strength of the patient. Sulphate of quinia, or infusion of Peruvian bark, the mineral acids, and a nutritious diet, are usually advisable. Chlorate of potassa, in the dose of five or six grains for a child from six to eight years old, repeated three or four times a day, may be employed with hope of advantage. Chalybeates will sometimes prove useful, especially in cases originating in miasmatic diseases. In cases of great debility, wine whey, with carbonate of ammonia or camphor, and animal broths should be resorted to. Constipation should be obviated by rhubarb, with or without magnesia; and opiates should be given throughout the complaint to relieve restlessness and pain.

But local measures are most to be relied on. As soon as a white or ash-coloured surface appears, some escharotic substance should be freely applied to it. Dr. B. H. Coates, of Philadelphia, who has seen much of the disease, has found a strong solution of sulphate of copper, in the proportion of half a drachm of the sulphate to a fluidounce of water, applied two or three times daily, so as to touch every portion of the diseased surface, by far the most effectual remedy. (*N. Am. Med. and Surg. Journ.*, vol. ii. p. 20.) Solid nitrate of silver, or a strong solution of the salt if sloughs are already formed, the mineral acids, and undiluted tincture of chloride of iron, have also been recommended as topical applications, and will in most cases be found effectual. The same may be said of a solution of sulphate of zinc, in the proportion of half a drachm to the fluidounce. Tincture of myrrh, decoction of Peruvian bark, and solution of alum have been employed; but are of little use, unless in promoting the healing process after the separation of the slough. The mouth should be washed with solution of chloride of soda or of creasote, to correct the fetor. The removal of the loosened teeth will sometimes be found useful, as their presence serves as a source of irritation, and sometimes interferes with the application of remedies to the whole surface diseased. When a gangrenous spot appears on the cheek, M. Billard advises, as the most effectual remedy, to make a crucial incision in the affected part, and to fill it with the butter of antimony, or to apply the actual cautery. The charcoal, carrot, or fermenting poultice, may be applied when the gangrene advances, the parts being frequently washed with an aqueous solution of creasote.

8. MERCURIAL INFLAMMATION OF THE MOUTH.—*Mercurial Stomatitis.*—There are various morbid states of the mouth depending upon peculiar general diseases, such as the scorbutic and syphilitic ulcers, and the variolous eruption; but these are more properly treated of under the heads of the diseases severally, of which they constitute a part. The effects of mercury upon the mouth may with the greater propriety be considered in this place, as an account of its general effects upon the system does not come within the plan of the present work.

Among the first indications of the action of mercury are often a metallic taste in the mouth, like that of brass or copper, and some increase of the saliva. At the same time, a close examination will detect a slight redness and swelling of the gums, particularly about the necks of the lower incisors, while somewhat below their edge, a broad white line may often be observed, depending on opacity of the epithelium. The patient soon begins to feel some uneasiness, complaining of soreness when the gums are pressed, and of pain when the teeth are forcibly closed together. There is also a sense of stiffness about the jaws when the mouth is opened, and the teeth feel as if projecting above their usual level. The flow of saliva increases, the inflammation extends, the gums and palate become obviously swollen, and the tongue covers itself with a yellowish-white or brownish fur, and is often so much enlarged as to exhibit the impressions of the teeth when projected from the mouth. The throat frequently becomes sore, and the cheeks, and salivary and absorbent glands, swollen and painful. There is often severe toothache or pain in the jaws. A whitish exudation along the edges of the gums is very common. The breath, which, from the beginning, and sometimes even before the appearance of any one of the symptoms mentioned, has a peculiar disagreeable odour, now becomes extremely offensive, and in bad cases almost intolerable. Ulceration often occurs, especially about the necks of the teeth, which are consequently loosened, and in the cheeks, lips, and fauces. The ulcers often have their origin in a vesicular eruption, such as that already described. (See *page* 501.) The whole mouth with its appendages is sometimes so much swollen that it can scarcely be opened; and the tongue so much enlarged as to project beyond the lips. The patient is now nearly or quite unable to articulate, or to masticate his food, and sometimes can scarcely swallow. A case was related by Dr. Physick, in his lectures, in which an obstinate dislocation of the jaw resulted from the enormous tumefaction of the tongue. Hemorrhage is not an unfrequent attendant upon these bad cases, and is sometimes so profuse as to be alarming. Sloughing also takes place, and portions of the jaw bone are occasionally laid bare. There is always, in the severe cases, more or less fever, which is partly symptomatic of the local affection, partly the direct effect of the mercury. Death, from the exhausting influence of the irritation, want of nourishment, and hemorrhage, has occurred in numerous instances; but the patient generally recovers from the worst forms of the affection, though sometimes with a deformed mouth. The tongue and cheek have occasionally adhered at points where their ulcerated surfaces were in contact, and a surgical operation has been necessary to remove the evil.

Some individuals are exceedingly susceptible to sore mouth from mercury; the smallest quantity of the mineral being sufficient to produce severe effects. Others again are scarcely affected, in this way, by any quantity of the medicine which can be administered. The preoccupation of the system by a very violent disease presents, in many instances, a complete obstacle to its action upon the mouth. Thus, in yellow fever it is sometimes utterly impossible to induce the mercurial salivation.

Treatment.—Mild cases of this affection require no treatment. In severe cases, it is usually advisable to keep the bowels loose by saline cathartics, to confine the patient to a liquid farinaceous or milk diet, and to allay nervous irritation and pain by opium. In some rare instances, when the inflammation is intense and the pulse strong, it may be proper to draw blood from the arm. Care should be taken that the patient be clothed in flannel, and breathe a pure air. The compound decoction of sarsaparilla, to the amount of a quart daily, has been recommended as a diluent. The internal use of chlorate of potassa has also been recommended as highly useful, though requiring caution. (See *Am. Journ. of Med. Sci.*, N. S., xiii. 169.)

In the local treatment, it is usually sufficient to wash the mouth and throat with warm demulcent liquids, or mild astringent decoctions or infusions. Of the former, barley-water, flaxseed tea, and infusion of sassafras pith or benne leaves; of the latter, common green tea, decoction of galls or black alder, and infusion of red roses, or of the berries or inner bark of the upland sumach may be employed. The astringent preparations should be weak, and may be advantageously associated with laudanum. Perhaps no wash for the mouth is preferable to a solution of acetate of lead, in the proportion of two or three grains to the fluidounce. A solution of alum may also be employed; and, when ulcers exist, a strong solution of sulphate of zinc or nitrate of silver may be applied by a camel's hair pencil to the ulcerated surface. Half a drachm of nitrate of silver may, for this purpose, be dissolved in a fluidounce of distilled water. To correct the fetor, washes made with chloride of soda or of lime, or with creasote, will be found most effectual. Tar smeared over the surface of the mouth has been recommended. Dr. Wilcox, of Elmira, New York, has obtained extraordinary success from the use of a decoction of the smart-weed, employed in the same manner as recommended in the sore-mouth of nursing women. (See *page* 505.) When the inflammation and swelling are great, leeches may be applied under the lower jaw, or over the parotids. I have found blisters to the sides of the face and neck very useful in relieving pain.

Article II.

INFLAMMATION OF THE TONGUE, or GLOSSITIS.

The term Glossitis (from γλωσσα, tongue) is here applied to inflammation of the substance of the tongue; inflammation of the mucous membrane of that organ having been included in stomatitis. This is often very sudden in its attack, and rapid in its progress. Some portion of the tongue, most commonly the anterior part, becomes red, painful, and swollen; and, in the course of a few hours, the inflammation extends throughout the organ, which enlarges so much as to fill the whole mouth, to force open the jaws, and sometimes to project considerably beyond the teeth and lips. The floor of the mouth is obviously much depressed, the soft palate elevated, and the epiglottis, in some instances, so much pressed down as to endanger suffocation. Deglutition is very difficult, if not impossible; and the patient is wholly unable to articulate. The tongue is usually red or dark-coloured, and dry upon the surface; though sometimes it is moist, and covered with a thick whitish or yellowish fur. Not unfrequently the neighbouring parts participate in the inflammation. The system sympathizes, and a quick strong pulse, and hot skin usually exist in the earlier stages; but, as the complaint advances, and respiration becomes embarrassed, the pulse loses its strength, and cold sweats occur. The inflammation may terminate in resolution; but, if not interrupted by remedial treatment, it is apt to run into suppuration or gangrene, unless, indeed, the patient previously die of suffocation, or of apoplexy from the impeded return of blood from the head. Sometimes permanent induration is left upon the subsidence of the inflammation. Less destruction is produced by gangrene than might be imagined from the large sloughs thrown off by the tongue; for, when the organ shrinks to its original size, the loss is often found inconsiderable.

Causes.—Glossitis may result from the usual causes of inflammation. Perhaps the most frequent cause is direct injury, resulting from irritating or corrosive substances, scalding drinks, wounds or bruises, or the bites or stings of venomous insects. Sometimes the affection is produced by a direct propagation of inflammation from the tonsils, and it occasionally arises in the course of exanthematous fevers. In some instances, the chief force of the mercurial action appears to fall upon the tongue, and to produce immense tumefaction.

Treatment.—The rapid and dangerous character of this disease requires prompt and efficient treatment. As much blood should be immediately taken from the arm as the strength will permit, and the bleeding should be repeated once and again, if necessary to arrest the progress of the inflammation. If deglutition is possible, the patient should be purged freely with sulphate of magnesia, or with this salt combined with infusion of senna, or with some other active cathartic. Should it be impossible to administer medicines by the mouth, the bowels should be kept open by enemata. The diet should consist exclusively of farinaceous drinks. When the patient is unable to swallow liquids, thirst may be alleviated by bathing, copious diluent enemata, and the cautious application of lemon-juice to the surface of the tongue.

The remedy on which, however, after general bleeding, the chief reliance must be placed, are leeches applied beneath the lower jaw, and to the upper anterior part of the throat. To be efficient, it is necessary that the bleeding should be very copious. As many as one hundred American leeches may be applied at once, if the strength of the patient permit. They should have been preceded by venesection. Some recommend their application directly to the tongue; but, in general, leeches act better when applied in the vicinity of an inflamed organ than immediately to it; as the irritation from their bites is sometimes very injuriously superadded to the existing disease. The opening of the ranular veins has also been recommended; but it is not always easy to reach them in the swollen state of the tongue; and there is danger of wounding the ranular arteries in the operation. The cases seen by the author have yielded to the free use of leeches externally, beneath the floor of the mouth, after suitable general depletion. After the leeching, emollient poultices may be employed; or recourse may be had to blisters. But, should leeches not be attainable, or should they have been employed without success, and the danger of suffocation appear imminent, free incisions should be made into the substance of the tongue, one on each side of the median line, extending from the base to the tip. Care, however, should be taken, not to make them so deep as to endanger the wounding of the ranular arteries. Blood flows freely from the incision, and the size of the tongue is rapidly diminished. Another advantage is the escape of the pus, if suppuration should have taken place. If, notwithstanding all these measures, suffocation is threatened, it will be necessary to open the larynx; and cases may exist so immediately dangerous, that this operation should be at once resorted to, without awaiting the slower effect of other means of relief.

If an abscess form in the tongue, it should be opened by a bistoury, and mild emulsions or mucilaginous liquids, with the addition of honey of roses or simple oxymel, may be afterwards applied. Should the healing process be slow, it may be advantageously stimulated by tincture of myrrh and decoction of bark, or other analogous washes. In cases of gangrene, the mouth should be washed with chloride of lime or of soda, aqueous solution of creasote, or decoction of bark acidulated with the mineral acids.

Article III.

MORBID DENTITION.

It has long been observed that, during the process of dentition, children are more liable to disease than at other times, and that this is the most fatal period of life. It is probable, however, that the influence of the process has been much exaggerated. It occupies a large portion of that stage of growth, when the susceptibilities of the system are most acute by nature, and least blunted by habit, and when morbific causes in general must have the greatest influence. It is at this time of life also that exposure usually begins, and the child becomes liable to those diseases, such as measles, hooping-cough, &c., which occur but once. It is, moreover, during dentition that the change of diet usually takes place from the milk of the mother to other and unaccustomed kinds of food, and that the maternal milk itself becomes deteriorated by the institution of new or suspended physiological processes. Independently of teething, therefore, it would be inferred that this period of life must be unusually fatal; and it is an error to ascribe the result exclusively to that process. Still, there can be no doubt that it exercises an important influence, and that its derangements are among the most fruitful sources of danger to infant life. The pressure of the growing teeth upon the surrounding parts almost necessarily occasions some uneasiness, and frequently produces so much irritation and inflammation as not only to cause great local suffering to the child, but also to call various functions into sympathetic disorder, and even to set on foot serious organic diseases. This is easily understood, when it is considered that, in infancy, not only are the susceptibilities most acute, but the sympathies also peculiarly active, from the necessity in which the system is placed, in the rapid developement of all its parts, to guard against irregular results by the rapid diffusion of impressions from each part to every other.

The investing membrane of the tooth, and the gum over it, against which the body presses in its progress, and which is absorbed in consequence of this pressure, are the parts which chiefly suffer; though it is highly probable that the roots also occasion distress, during their developement, by incommoding the dental nerves. The irritation thus occasioned is probably often productive of tingling, itching, or other vague uneasiness, different from pain, and even more difficult to be borne; for the child instinctively seeks relief by biting upon hard substances, or otherwise pressing them against his gums; the slight pain thus occasioned being more tolerable than the sensation which it displaces. This irritation may sometimes even occasion serious constitutional disturbance, especially of a nervous character; for such disturbance has been apparently relieved by lancing the gums, even when no obvious inflammation existed. The feeling of relief from pressure may be experienced, even when the gum is considerably swollen, hot, and painful; but, when the surface becomes of a deep red, or assumes that vesicular appearance which sometimes precedes the eruption of the tooth, it is usually exceedingly tender to the touch. During difficult dentition, the saliva flows more freely; the child becomes fretful, peevish, restless, and wakeful at night, frequently putting his fingers into the mouth, and sometimes screaming violently, and almost incessantly. In some instances, the inflammation extends to neighbouring parts, affecting the absorbent and salivary glands, and the mouth becomes hot and dry.

The sympathetic effects of teething are generally in proportion to the local affection, which is greatest when many teeth are advancing at the same time. They bear also some relation to the constitution and age. Delicate children usually suffer more than the robust, because the process is more protracted; and the danger is greater in premature than in late dentition, because the susceptibilities of the system are greater. From the peculiar mobility of the nervous system of infants, this is very apt to suffer, especially the brain. Hence restlessness, wakefulness, occasional spasmodic movements, and even convulsions. The respiratory organs sometimes participate in the nervous derangement; and there is reason to believe that spasm of the glottis, and very obstinate coughs, may originate in this source. But the irritation is most frequently directed to the alimentary canal. Looseness of the bowels is a very common attendant on teething, and, when not severe, may be considered as a salutary effort to relieve or prevent more dangerous affections, especially of the brain. Sometimes, however, it assumes itself a dangerous character, being attended with vomiting and great prostration, or becoming protracted, and wearing out the strength of the patient. The skin is also a frequent seat of the sympathetic irritation, and various eruptive affections are apt to appear during dentition. Among these, a pustular and ulcerative or scabby disorder behind the ears is not uncommon. The circulation generally participates more or less in the irritation; and fever not unfrequently occurs. Besides all these direct results of diseased dentition, it is apt to aggravate almost all co-existing diseases.

Treatment.—The child should in general be exposed to cool fresh air, and the bowels, if at all disposed to costiveness, should be kept open by a laxative diet, or by mild cathartics, such as manna, magnesia, or castor oil. If there should be much fever with costiveness, a dose of calomel will often be found useful. In this case, cool drinks, and some of the refrigerant diaphoretics may also be given, particularly the neutral mixture, and the spirit of nitric ether, which often has a happy effect in controlling irregular nervous action. The stomach should never be loaded with food, and the diet should be light and of easy digestion, and proportioned to the degree of existing excitement. Attendant or consequent diseases must be treated as when they occur under other circumstances; reference, however, being always had to the fact, that diarrhœa and cutaneous eruptions often afford a safe outlet to the irritation, and should not be too hastily removed, lest this might fall dangerously upon the brain. The disorder behind the ears is apt to be unsightly and troublesome; and mothers are often anxious for its cure; but it should rather be encouraged than removed; and the late Dr. Joseph Parrish, of Philadelphia, used to insist upon the importance, not only of not interfering with this salutary process of nature, but even of imitating it, in cases of much obstinacy or danger, by keeping blisters open in the same situation.

The local treatment of diseased dentition is highly important. When a mere irritation exists, without much inflammation or disturbance of the health, it may be sufficient to allow the child to chew upon some hard substance, as a smooth piece of wood or ivory; but, when the gums are swollen, and any derangement in the functions occurs, incisions should be made without hesitation down to the teeth, so as to divide both the gum and the investing membrane. These may be made by a gum-lancet, or a sharp penknife, and should always be free. Over the front teeth, the incision should be single, but over the double teeth of a crucial form. Lancing the gums often affords great and immediate relief. It is useful, in some measure, by the bleeding which ensues, and is therefore not always without benefit, even when superficial; but its chief advantage is the liberation of the tooth, and the removal of the tension of the gum and membrane. The objection which has been urged against it, that the incision often heals before the tooth appears, and thus leaves a scar more difficult to penetrate than the original gum, is altogether without foundation. So far from affording an increased resistance to the progress of the tooth, the scar partakes of that diminished vitality of all new formed parts, which causes them to yield to the absorbent process more readily than the original structure. It is asserted that lancing the gums is sometimes useful, even when no swelling appears, by relieving the tension and irritation of the parts immediately around the tooth. Some caution, however, is here requisite; as too early a division of the capsule which secretes the enamel of the tooth may interfere with the proper formation of that structure; and Guersent states, as the result of his observation, that teeth, thus prematurely exposed, make their way through the gums more slowly than the others. (*Dict. de Méd.*, x. 139.) Should the inflammation be obstinate or extensive, and not yield to the division of the gums, a few leeches may be applied upon the outside of the jaws, and a pair of blisters behind the ears; and the blisters may be repeated, or kept open by stimulating dressings.

Article IV.

TOOTHACHE, or ODONTALGIA.

Toothache scarcely deserves the name of a disease, being merely a symptom of various morbid states of the affected part; but, as it is in general the most prominent circumstance in connexion with the affection which it accompanies, and that to which the attention of the practitioner is chiefly called; and as it affords the means of connecting in one view several disorders of the teeth, or their appendages, which scarcely deserve a distinct heading in a work like the present, it is employed as a title to this article.

Toothache offers every possible variety in degree, character, and duration. The pain runs through all the grades which intervene between a slight sensation of uneasiness and insupportable agony. It may be dull, aching, heavy, sharp, pungent, throbbing, grinding, or lancinating. It may be continued or paroxysmal, remittent or intermittent, and regular or irregular in its recurrence. It may come in flashes, and as suddenly disappear; or may continue a long time with little variation. Its varieties will be best considered under the different pathological conditions which it attends.

1. NERVOUS OR NEURALGIC TOOTHACHE.—A purely neuralgic condition of the teeth is not uncommon. The affection may be seated in the nerve of a single tooth; but it much more commonly occupies the nervous trunk from which several teeth are supplied; and not unfrequently affects rather the jaw than the teeth themselves. The pain is in general of the acute character, sometimes mild in the beginning, gradually increasing in intensity, and as gradually declining; but usually very irregular, at one time moderate, at another severe, and occasionally darting with excruciating violence through the dental arches. Not unfrequently it assumes a regularly intermittent form. Instead of pain, strictly speaking, the sensation is sometimes of that kind which is indicated when we say that the teeth are on edge, and is apt to be excited by certain harsh sounds, such as that produced in the filing of saw teeth, by mental inquietude, and by the contact of acids or other irritant substances. Neuralgic toothache sometimes persists with intervals of exemption, for a great length of time, and becomes the torment of the patient's existence. The diagnosis is occasionally difficult. When, however, it occurs in sound teeth, is paroxysmal in its character, is attended with little or no swelling of the external parts, occupies a considerable portion of the jaw, and especially when it alternates or is associated with pain of the same character in other parts of the face, there can be little doubt as to its real nature.

This variety of toothache may depend on a morbid state of the nerve or nerves which are the immediate seat of it, but more frequently originates in a condition of the nervous system, such as disposes to neuralgic pains generally. This will be considered under the head of neuralgia. With an existing predisposition, it is sometimes invited by caries, but very frequently occurs in teeth which are perfectly sound. Almost anything which disturbs the system may serve as an exciting cause; but the most frequent causes are probably vicissitudes of weather, and the application of very cold or very hot substances to the teeth, especially in alternation. The disease appears to be sometimes sympathetic with morbid states of the stomach or other distant organs; and not unfrequently occurs in persons of a gouty or rheumatic diathesis.

Treatment.—In plethoric cases with a strong tense pulse, general bleeding may be employed; but this is seldom necessary or advisable, and in cases of debility might aggravate the affection. In the latter cases, after due evacuation of the bowels, tonic medicines, especially the subcarbonate of iron, in doses of one or two drachms three or four times a day, and the sulphate of quinia freely administered, are often useful, and sometimes will effect a cure. The narcotics are also beneficial. The extracts of belladonna, stramonium, hyoscyamus, conium, and aconite, may be employed singly or in combination. Opium or some of its preparations are occasionally necessary to relieve the violence of the pain. When the neuralgic affection can be traced to sympathy with disease elsewhere, this should be corrected. Thus, antacids should be given in acidity of stomach, laxatives in constipation of the bowels, the blue mass or calomel in deranged or deficient hepatic secretion, aloes or other emmenagogue in amenorrhœa; and not unfrequently the co-existence of two or more of these affections calls for the simultaneous use of the appropriate remedies. If a rheumatic or gouty diathesis be suspected, wine of colchicum, hot pediluvia, and other means adapted to these disorders may be tried. Peruvian bark or sulphate of quinia will be found an almost certain remedy in regular intermittent cases, and often useful in others. Mercury is sometimes effectual, when the disease has resisted all other treatment. In fact, whatever alters materially the distribution of nervous influence, and changes the condition of the system, offers a chance of benefit. Hence the employment of general frictions, and of cold and hot baths, sometimes proves advantageous. In very obstinate cases, a total change of scene and habits is often highly beneficial. An excursion to some watering-place, a protracted journey, and especially a sea voyage, with long continued foreign travel, will often effect permanent cures when the catalogue of medicines has been exhausted in vain. The diet should be accommodated to the condition of the system, and of the digestive organs.

The local treatment consists of leeching in plethoric cases, anodyne embrocations or poultices, sinapisms and other rubefacient applications, frictions with veratria or strong tincture of aconite, blisters with a salt of morphia sprinkled on the denuded surface, moxa in the course of the nerves or on the side of the neck, cold water or ice to the cheek, steaming the face with the vapour of hot water, either pure or combined with volatile narcotics, tobacco fumigations, irritant and anodyne masticatories, errhines, electricity or galvanism, and all other topical means employed in the treatment of neuralgia. (See *Neuralgia*.) Chloroform, locally applied, will probably be found the most efficient anodyne. When a single tooth is affected, relief is sometimes afforded by its extraction; but this measure often fails, and always when several teeth are involved. Carious teeth should generally be removed in these cases, if the affection has proceeded far.

2. INFLAMMATORY TOOTHACHE.—This may exist with or without caries; but is in the great majority of instances dependent upon that affection. Before proceeding, therefore, to an account of its phenomena, it will be proper to say a few words on the subject of carious teeth.

Caries is an affection of the interior or bony structure of the teeth, the enamel being without vitality, and not therefore subject to morbid action. Some have denied to this disease a claim to the title of caries; because nerves and blood-vessels have not been traced in the substance of the teeth, and no process of absorption or granulation, by which the diseased part can be separated, and its place supplied by new structure, takes place. Thos. Bell, however, maintains that nerves and blood-vessels do exist, the former, because the tooth has a certain degree of sensation, the latter, because a red injection may occasionally be observed in its substance, and a yellowish colour is sometimes imparted to it in jaundice. (*Bell's notes to Hunter on the Teeth.*) There can scarcely be a doubt, that the bony portion of the tooth is organized, and is therefore subject to morbid action; and, though this may not present exactly the phenomena observed in caries of bones of a higher degree of organization, it approaches somewhat towards it in character.

Caries sometimes begins on the internal surface of the tooth, and extends outward, exhibiting usually, as the first evidence of its existence, a dark appearance beneath the enamel. (*Good's Study of Med.*) But, much more frequently, it proceeds from without inward, commencing in the bone immediately beneath the enamel, and exhibiting a yellowish or brownish spot in this situation. The tissue is softened, and a small cavity formed, which, after a time, communicates externally by the crumbling of the unsupported enamel over it. The substance of the tooth now decays more rapidly; and the caries, exhibiting a yellowish, brownish, or blackish colour, gradually approaches the central cavity of the tooth, which is at length opened. The caries is said to advance most rapidly in those cases in which the surface is yellowish. At first there is little or no suffering; but, when the disease has reached the cavity of the tooth, the pulp becomes sensible to heat, cold, and the action of irritant substances, and pain is experienced. At length inflammation takes place, which speedily advances to suppuration, and the pulp is gradually destroyed by ulceration or gangrene. The body of the tooth, deprived of the nourishment which it received from the pulp, decays entirely, leaving only the outer coating of enamel, which then breaks off by degrees, until nothing but the roots are left. These usually, though not always, cease to give pain. In some cases, especially when the surface is black or very dark, the caries advances very slowly, or is altogether arrested. In such cases, the surface is commonly also harder and less friable than in the yellowish caries.

This decay of the teeth is not necessarily attended with pain. Occasionally the affection runs through its whole course, with little or no suffering to the individual; and sometimes, after having been painful, it ceases at certain periods of life to be so, though the process of decay may continue. In some instances of caries without toothache, the irritation appears to be felt sympathetically in other parts; and painful affections of the head, ears, and eyes, have ceased upon the extraction of a decayed tooth, which had never ached. I have seen violent and obstinate headache yield to the extraction of a tooth which had not been painful; and Dr. I. Hays, of Philadelphia, has described several cases of excessive photophobia which depended on the same cause, and yielded to the same remedy. In these cases, though the tooth may not ache, it will be found painful when pressed upon or struck smartly. (*Trans. of Col. of Phys. of Philadelphia*, ii. 411.)

The most frequent cause of caries is probably some condition of the bone acquired during its formation, in consequence of peculiarity of constitution, or the state of health existing at the time. Thus, persons affected with scrofula or scurvy, during dentition, are apt to be affected with decay of the teeth in after life. There is reason also to believe that the predisposition is sometimes hereditary. Women and young children are more subject to the disease than men. The direct or exciting causes are either such as destroy the integrity of the enamel, and thereby expose the bone to the influence of irritant substances, or such as operate directly upon its vital susceptibilities. Among the former are acids and other corrosive substances taken into the mouth, sour eructations from the stomach, depraved salivary or mucous secretions, the sordes which collect about uncleaned teeth, the contact or near vicinity of a carious surface in another tooth, the attrition of opposing surfaces of the teeth, and all kinds of mechanical violence. Of the latter, the principal are heat and cold suddenly applied, and especially in quick alternation. Hence it is, perhaps, in part, that caries of the teeth is more common in civilized life, where hot drinks are habitually used, than among savages. The very free use of sugar, as an article of diet, is thought by many to be a frequent cause of the disease. Some have ascribed its effects to direct action on the teeth; but it is more probable that it operates, if at all, by impairing digestion. Whatever deranges the digestive function may occasion caries indirectly, by giving rise to acrid and corrosive eructations, and by altering the secretions which are poured into the mouth. Nevertheless, sugar is certainly strongly irritant to the dental nerves; as is evinced by the severe toothache so often occasioned by its contact with a carious surface.

When the caries is slight, and especially when it occupies the sides of the teeth, it may often be arrested by removing the diseased portion with the file; and the same end may be attained by filling the cavity with some metallic substance, such as lead, tin foil, or gold leaf, so as to exclude the air and all irritant bodies. Plugging may be resorted to in all cases when the tooth has not begun to ache, or when it has ached but moderately and for a short time.

Having premised these remarks respecting caries of the teeth, we are prepared to enter upon the consideration of inflammatory toothache. It is proper previously to state that, in carious teeth, and in those deprived of their enamel without being absolutely carious, pain may be produced by the contact of irritant bodies, without the existence of inflammation. But the action thus excited, when not purely neuralgic, is an irritation which is the first step towards inflammation, and will inevitably lead to it if continued. The inflammation which occasions toothache may be seated in the pulp of the tooth, in the cord which enters its lower extremity, or in the periosteum investing its roots, and reflected over the interior of the alveolar cavity. Sometimes this inflammation terminates in resolution, without producing any swelling of the gum; and, in such cases, especially when the tooth itself is sound, the diagnosis is not easy between the inflammatory and neuralgic toothache. But the former is usually confined to one tooth, while the latter generally extends to several. Besides, the pain in the inflammatory variety is less sharp, less irregular, and less disposed to the paroxysmal form. Most commonly, however, after the pain has continued a short time, some external swelling appears. At first the pain is usually moderate, and it may continue thus throughout; but generally it increases, and at length becomes intense, in consequence probably of the pressure to which the swollen and inflamed parts are subjected by the unyielding bone around them. The tooth is at the same time very tender; and any force applied to it greatly increases the pain. The inflammation is propagated by contiguous sympathy to the gum and other parts of the face, which become much swollen; and the swelling sometimes extends to the salivary and absorbent glands, and even to the tonsils. The violence of the pain often abates somewhat upon the occurrence of this external inflammation, which appears to act as a revulsive. The tumefaction not unfrequently subsides without the occurrence of suppuration, and the toothache ceases for a time. Very frequently, however, an abscess forms either in the gum, upon the upper or lower jaw, in the roof of the mouth, or, more rarely, in the substance of the cheek. There is often much constitutional disturbance, with fever, headache, and inability to sleep. The pain, during the suppurative stage, is usually pulsative or throbbing. The abscess at length opens and relief is obtained. The duration of an attack of this kind is usually six or seven days, though sometimes much longer. When the abscess is seated in the palate, it is generally of slower progress, and sometimes continues for weeks or months without opening; but in the latter case the pain is not acute. The patient, though relieved for a time, is liable to constant returns of the affection in cases of carious teeth, until these are wholly destroyed in the course of the disease, or are artificially removed.

Suppuration also takes place in the pulp or dental cord. If an opening exist into the central cavity of the tooth, the pus may be discharged by this route; but, if there be no such outlet, the matter accumulating occasions inflammation and absorption of the socket, and thus makes itself a way out, either between the tooth and the gum, or directly through the latter, forming an abscess in its substance. When this opens, the pain is relieved; but the opening is apt to become fistulous, and a continual purulent discharge to be maintained until the tooth is wholly removed.

There is some distinction between the symptoms of the inflammation seated in the different parts above referred to. When it is in the pulp alone, the tooth is painful upon percussion, but suffers less when pressed against the opposite tooth, as in the closing of the jaws. The pain is often exceedingly severe, and is increased by hot and cold liquids taken into the mouth. Sometimes, in these cases, a fungous growth projects through the carious cavity. This, if inconvenient, may be removed by excision or by caustic. When the inflammation occupies the cord, the pain is seated deep in the jaws, and is much increased by closing the teeth firmly. It may be dull or acute; but is less excruciating than that of the pulp, and is not equally affected by hot and cold liquids. When the tooth is extracted in these cases, pus is often discovered about the extremity of the root, and is sometimes collected in a small pouch. If the upper molar teeth are affected, the inflammation sometimes extends to the antrum, producing very serious results. When the periosteum of the root is the seat of inflammation, the pain is deep in the jaws, and the tooth feels elevated above its usual level, and is often somewhat loose. Closing the teeth is here also very painful. Rheumatic inflammation is apt to attack this part.

The most frequent cause of these inflammatory affections is the exposure of the pulp, consequent upon caries, or other destruction of the tooth. They may result also from vicissitudes of temperature, retrocession of cutaneous eruptions, the suppression of accustomed discharges, the translation of rheumatic or gouty inflammation from other parts, the pressure of osseous concretions in the cavity of the tooth, and from direct violence.

Treatment.—Little general treatment is requisite. Saline cathartics, and abstinence from animal food may be recommended when the inflammation affects the neighbouring parts; and an opiate at night is generally advisable when the pain is severe. The loss of blood may become necessary if there should be strong determination to the brain.

Much may be done locally to afford relief, and hasten the cure. The means are sedative, anodyne, and revulsive applications, and depletory measures, either within the mouth or externally. Among these remedies are brandy, or tincture of camphor, held in the mouth; the chewing or smoking of tobacco; various masticatories, such as ginger, calamus, pellitory, &c.; poultices to the face, either simply emollient, or rendered anodyne by the admixture of laudanum, hops, &c.; anodyne lotions, as tincture of camphor with laudanum; rubefacient applications, as capsicum, ginger, and mustard in the form of cataplasm; blisters to the side or back of the neck, or behind the ears; steaming the face and head with the vapours of hot water; scarification of the gums; and, finally, leeches outside of the face or to the gums, when the inflammation is considerable, and it is deemed highly desirable to bring about resolution. In most cases, the milder of these means are sufficient; as the disease is generally soon relieved by suppuration, and the discharge of the pus. After the abscess has formed, it should be opened if it do not speedily discharge itself; and, if it occupy the substance of the cheek, care should be taken to make an early opening inwardly, lest it might break externally and leave an unsightly scar.

When caries exists, in addition to the means just mentioned, applications may be made to the cavity of the tooth itself. These are usually such as relieve pain by their anodyne, or obtund sensibility by their excessively irritant action. They consist chiefly of laudanum or opium, in reference to the former effect; and of certain volatile oils, as those of cinnamon, cloves, and cajeput, in reference to the latter; all of which should be introduced on cotton. The most efficient of these applications, in the experience of the author, is creasote. Put undiluted into the carious cavity, this substance not only relieves, but also for a time often effectually cures toothache. It probably acts both by obtunding the sensibility of the pulp, and by coagulating any albuminous matter which may be present, and thus forming a barrier against the external air. A solution of copal in chloroform has been strongly recommended. The chloroform relieves the pain, and the copal, by its adhesiveness, retains the cotton in the cavity, and protects it from the air. (*Journ. de Pharm. et de Chim.*, xiv. 125.) Collodion has been applied to the interior of the cavity, with the view of protecting the part from the air and from irritating substances, with great asserted advantage. Strong astringents, such as galls and catechu, are sometimes used; but they answer better as preventives than cures, and are not unfrequently employed to prepare the carious tooth for plugging. If opium is used, care should be taken that the quantity be not so great as to do serious injury if swallowed. Attempts are sometimes made to effect a permanent cure of toothache by destroying the nerve by means of a heated wire, or removing it by means of suitable instruments; but, though sometimes successful, they often fail in unskilful hands, and are not generally advisable. When there is reason to believe that the pulp is inflamed, in consequence of caries or from other cause, the practice, suggested by Dr. Hullihen, of Wheeling, has been adopted by several American dentists, with great asserted benefit, of drilling a hole into the cavity of the pulp; thus allowing any pus which may have been produced to escape, and aiding the recuperative efforts of the pulp by removing pressure from it. (See a paper by Dr. John Trevor, in the *New York Med. Gaz.*, iv. 104.)

When a tooth frequently becomes painful, and is too far gone to be saved, especially if the general health suffer, it should be extracted. In cases of dental fistulæ, it is generally advisable to remove the tooth, or such part of it as remains. The first teeth in children may be freely extracted, when carious and painful, as they are followed by others. But, in deciding as to the propriety of extraction, it should always be borne in mind that, when the permanent teeth are removed, the alveolar processes of the jaws are absorbed, and the cheeks or lips fall in, producing an appearance of old age. Besides, a carious tooth is often useful in mastication, in the intervals of pain. Another consideration is, that the occurrence of caries of the teeth sometimes appears to act as a derivative from the lungs, and to afford relief in pulmonary complaints. In such cases, the teeth should be allowed to remain.

As a means of preserving the teeth, they should be thoroughly cleansed, and not only in the morning, but after each meal. Dr. Bowditch, of Boston, has found that, in healthy states of the mouth, animal and vegetable parasites rapidly form between the teeth, and at their roots, probably from the presence of impurities; and it is not improbable that they may contribute to produce disease in these parts. (*Am. Journ. of Med. Sci.*, N. S., xix. 364.)

3. RHEUMATIC AND GOUTY TOOTHACHE.—This is either neuralgic or inflammatory, and might have come, accordingly, under one or the other of the two preceding heads. But there is something peculiar in its character, which often serves to distinguish it from toothache of a different origin, and demands a somewhat peculiar treatment. It may, in general, be recognized by its occurrence in individuals of a rheumatic or gouty predisposition, by the simultaneous or immediately antecedent existence of these diseases in other parts of the body, by its extension for the most part through several teeth or even the whole jaw, and by the fact, that it is seldom or never attended with suppuration. The pain is, in the inflammatory variety, rather dull than acute. It is apt to be induced by vicissitudes in the weather. It may occur either in carious or sound teeth. In most cases, it is probably seated in the periosteum about the root, or the lining of the alveolar cavity, or on the external surface of the jaw, rather than in the pulp, or in the dental cord. In addition to the local measures enumerated, the constitutional treatment applicable to other forms of rheumatism or gout may be employed; and efforts may be made by stimulating pediluvia to invite the disease to the lower extremities.

4. TOOTHACHE FROM EXOSTOSIS.—As a consequence of inflammation, or

from some other cause, the periosteum about the root of the teeth sometimes becomes ossified, and a bony deposition takes place so closely connected with the root, as to have been taken for exostosis. It is possible that a proper exostosis of the fang may also occur; but the affection, as ordinarily observed, has its seat originally in the periosteum. The tumour has been known to acquire considerable size and to occasion great inconvenience. The pain is at first slight, but becomes severe in the advanced stage, in consequence of pressure upon the sensitive parts. There are no means of distinguishing this, with certainty, from other forms of toothache; but it may be suspected when the pain is constant, and not materially increased by closing the teeth or by striking them, and when no external inflammation is observable. It is said to occur most frequently in persons of a rheumatic or gouty habit. In the advanced stage, there is no other remedy than extraction. According to Dr. Good, it may be cured in the early stage by leeches and mercurial ointment; though it must be confessed that the obscurity of the diagnosis throws some doubt over the accuracy of this statement.

It is due to M. *J. E. Oudet*, to state that many of the facts detailed in this article are derived from his elaborate essay on the teeth, contained in the *Dictionnaire de Médecine.*

Article V.

FALLING OF THE TEETH.

The absorption of the socket, and consequent loss of the teeth, which are apt to occur in advanced life, are to be regarded rather as a physiological than a morbid process. But, in consequence of certain diseases affecting the alveoli and gums, the teeth occasionally fall out prematurely, although not themselves apparently diseased. This happens in scurvy, in canker and gangrene of the mouth, and occasionally as a consequence of mercurial inflammation of the gums. In carious teeth, after the loss of the body by the advance of the disease, the roots are sometimes cast off through the ulceration and absorption of the alveoli, occasioned by their irritative influence. These affections, however, have already been, or will hereafter be noticed. The object, in this section, is to call attention to two morbid conditions, which lead to the same result, and are not elsewhere described in this work.

In one of these affections, the gums swell and assume a deep-red colour, and the inflammation appears to be propagated into the alveoli, producing a thickening of the periosteum, and a consequent elevation of the tooth above its ordinary level. This condition is relieved after a short time, but again recurs, and by its frequent returns, the tooth is lifted out of the socket, while the gum retreats from the neck, leaving portions of the roots exposed. The bony alveoli, thus in a certain degree unoccupied, appear to undergo absorption; and the tooth, deprived of its support, and separated by the ulceration of the gum from its soft connexions, at length falls. The gum then heals, and the patient, who has usually suffered considerably during the progress of the affection, is restored to comfort. The disease commonly attacks a few teeth at once, commencing sometimes with the incisors, sometimes with the molares, and, though it occasionally produces only a partial loss of the teeth, in other cases does not cease until it has destroyed the whole. It seldom occurs before the thirtieth year. It appears, in some instances, to result from long continued mental trouble, and is said especially to affect women during pregnancy, and about the period of the cessation of the menses. Its causes, however, are not well known. The remedies indicated are those calculated to relieve inflammation of the gums; but they generally fail.

The other affection has been named by Jourdain, *conjoint suppuration of the gums and sockets.* It usually comes on insidiously, showing itself at first only by a slight oozing of purulent matter from behind the edges of the gums, when they are pressed. Sometimes, however, the gums are swollen and soft, disposed to bleed, and somewhat painful before suppuration; and, in a few instances, a real phlegmonous abscess in the gum is the commencement of the disease. The periosteum of the fang and of the socket after a time takes on the suppurative process, and matter escapes freely between the gums and teeth. The portion anterior to the tooth is generally first affected, but the whole socket is ultimately involved. The gums, at first of their natural colour, now become deep-red, and the teeth loose and painful. The bony socket is absorbed, first anteriorly and then behind; and the gums come into contact with the roots. This excites additional inflammation, and the ulcerative process at length separates the gum from the teeth, which then fall out, if not previously removed by the dentist or surgeon. After the loss of the teeth, the gums heal without difficulty. This complaint, as a general rule, attacks the incisors first. It occurs usually between the ages of thirty-five and fifty, more frequently in women than in men, and especially about the period of the cessation of the menses. Oudet thinks he has observed that those females who have not suckled their children are more subject to it than others. Among the causes of it enumerated by that author are residence in low and damp places, the action of mercury, the presence of tartar about the teeth, depressing emotions, suppression of hemorrhoidal discharges, retrocession of cutaneous eruptions, and certain disorders affecting the system, such as scrofula and syphilis. It appears also to be sometimes hereditary. M. Oudet considers the purulent discharge in this affection as in some instances salutary, by preventing or suspending serious diseases. I once attended a female with tuberculous consumption, who was several years labouring under such an affection of the gums, and in whom the symptoms of phthisis were not developed until this affection ceased, in consequence of the loss of all her teeth. The circumstance that the loss of the teeth is uniformly followed by the healing of the gums has led to the idea, that the complaint might be occasioned by the presence of teeth previously deprived of their vitality; but there is no sufficient proof of this fact, at least there is strong reason to believe that the disease has its origin, sometimes at least, in constitutional causes. The prospect of a cure is slight. In the early stages, it is possible that the application of nitrate of silver, or other caustic substance, to the whole diseased surface of the gum, might prove serviceable. M. Bourdet advises the actual cautery, applied by means of a flat and delicate instrument inserted between the gum and tooth, to the depth of the destruction of the socket. If this application, repeated once or twice, should fail, he advises the removal by the scissors of all that portion of gum which has been deprived of the bone which it covered. The most effectual mode of affording relief is to extract the teeth as they become loose. During the local treatment attention should be paid to the general health; and, where any tendency to pulmonary disease may be suspected, it may be advisable to attempt its prevention by the establishment of an issue. Might not cod-liver oil prove useful in these cases, if employed in the earliest stage?

SUBSECTION II.

DISEASES OF THE FAUCES, PHARYNX, AND ŒSOPHAGUS.

Article I.

INFLAMMATION OF THE FAUCES, or ANGINA.

Under the name of fauces, are included the velum pendulum, the half arches, the uvula, the tonsils, and the upper part of the pharynx; in other words, all those parts, behind the mouth, which become visible when the jaws are widely opened, and the tongue depressed. These parts may be attacked, like the mouth, by *thrush* and *aphthæ*, which, however, present nothing peculiar in this situation, and have been already fully considered. Nor shall I treat here of those forms of inflammation of the fauces which occur as attendants upon other diseases, such as scarlatina, smallpox, and syphilis. The forms of inflammation now to be considered may be embraced under the heads of 1. *the common*, 2. *the pseudo-membranous*, 3. *the ulcerative*, and 4. *the gangrenous or malignant*, all affecting the mucous membrane. Inflammation of the tonsils will be separately treated.

1. Common Inflammation of the Fauces.—*Sore-throat.*—*Simple Angina.*—*Angina Simplex.*—The first evidence of the complaint is usually some pain in swallowing. The fauces, if examined, are found to be of a bright-red colour, and occasionally somewhat swollen, and, in the advanced stages, often exhibit small whitish patches, especially on the surface of the tonsils, consisting probably of coagulable lymph, effused by the inflamed follicles. The redness may occupy one or both sides of the throat, the velum, or the pharynx, or may be diffused over the whole. The patient has a feeling of heat and dryness in the throat, with constant soreness, which becomes acute pain when he attempts to swallow. The pain is in general greatest in the morning, in consequence partly of the position of the head favouring the access of the blood, partly of the dryness resulting from the mouth being kept open during sleep. Drinks occasionally regurgitate through the nostrils. The voice is sometimes nasal, but more frequently hoarse, in consequence of the extension of irritation to the glottis. A viscid mucus is after a time secreted, which leads to frequent efforts to clear the fauces, and, when discharged, is sometimes mingled with blood. In some cases, the secretion of mucus is abundant, and these are usually attended with less redness and pain. They are considered by some as constituting a distinct variety of the complaint, and called catarrhal inflammation. They are apt to occur in persons of feeble constitution, with impoverished blood.

The uvula is sometimes much swollen and elongated, in consequence of effusion into its tissue. In this case, there is added to the other symptoms a frequent disposition to swallow, and to clear the glottis by coughing, or by expelling the air through the nostrils, and sometimes vomiting is produced.

The disease often runs its course without producing fever; but frequently also the constitution sympathizes, and the febrile movement, with chilliness, heat, frequent pulse, headache, and loss of appetite, occurs. The fever is usually of the sthenic character; but sometimes is typhoid, and, in certain cases, is attended with an exceedingly frequent pulse like that of scarlatina. In these cases, the colour of the inflamed membrane is usually deeper than ordinary; and the flushed appearance of the face and neck marks a still closer analogy with scarlet fever.

Dr. R. B. Todd, of London, describes a variety of angina, which he considers erysipelatous. Its chief characters are a dusky appearance of the inflamed surface, an almost total inability to swallow, not from swelling or mere pain, but from a seeming paralysis of the muscles of deglutition, great constitutional disturbance, and a tendency to rapid prostration, so that the case terminates fatally in two or three days if not arrested. (*Lond. Med. Times and Gaz.*, iv. 557.)

The inflammation, in ordinary cases, runs on for several days, and then gradually declines, terminating almost always in resolution. In some rare cases, suppuration takes place in the substance of the uvula or soft palate, and gangrene may occur in persons of debilitated and unhealthy constitution. The tonsils sometimes inflame, and the external parts participate in the disease; the jaws becoming stiff and painful, and the absorbent glands swelling. The most unpleasant ordinary result, however, is the travelling of the inflammation downward into the larynx, and even into the lungs; and, in some persons, severe bronchitis is very apt to follow an attack of simple angina, if not early arrested. Not unfrequently the Eustachian tube participates in the inflammation, and partial deafness results from its closure. This may be ascertained by causing the patient to close firmly the mouth and nostrils, and then endeavour to expire forcibly, or, as suggested by Mr. Toynbee, simply to perform the act of deglutition. If the tube is open, the air will readily enter the tympanum, otherwise not at all, or with difficulty. Another method, suggested by Prof. Richter, is to auscult over the ear with the cartilaginous portion pressed down so as to cover the external meatus. If the tube is open, the sound of the breath and voice is heard, otherwise not. (See *Am. Journ. of Med. Sci.*, N. S., xxv. 223.)

Chronic Angina.—Inflammation of the fauces often becomes chronic, in which case there is a constant feeling of heat and uneasiness with some redness of the parts, which, with alternations of remission and exacerbation, may continue for many months. In such cases, the membrane sometimes appears irregularly thickened, or exhibits here and there small eminences produced by the enlarged follicles, particularly observable on the soft palate and the pharynx. These granulations are often covered with a matter resembling the white of eggs, or a muco-purulent secretion. They are sometimes so numerous in the pharynx as to give its surface a mamillated appearance, and occasionally are associated in long prominences, or ridges, like pillars lying upon the membrane. The name of *granular* or *follicular angina* has been adopted by some writers for this variety. Ulcers also sometimes form, either superficial, affecting only the surface of the membrane, and then disposed to spread irregularly so as to occupy large portions of the fauces, or deeper seated, penetrating through the membrane, and even into the structure beneath it, and, in rare instances, producing considerable loss of substance. In such cases, however, the result is in general attributable either to a debilitated state of system, or to some vice of constitution, such as a scrofulous or scorbutic tendency, or a syphilitic contamination. The affection is often attended with an habitual hawking, in order to clear the fauces, or to get rid of the uneasy sensation as of something present in the throat, which may be delusive. A dry laryngeal cough is not uncommon, arising from the extension of the irritation to the glottis. In some persons, the disease ceases entirely for a time, and again recurs from the slightest cause, proving exceedingly inconvenient by its disposition to extend into the throat or chest. Sometimes it extends into the Eustachian tube, as in the acute form, causing hardness of hearing.

One of the consequences of repeated or long continued inflammation of the fauces is a chronic enlargement of the uvula, which proves very inconvenient by the irritation it produces about the root of the tongue and the glottis. Long continued and serious coughs have arisen from this cause, or been sustained by it. The irritation may even extend to the cerebral centres; and M. West, of Belgium, has recorded a case of long continued and harassing nightmare, which was completely relieved by the amputation of a much elongated uvula. (See *Am. Journ. of Med. Sci.*, N. S., xxi. 222.)

Causes.—The most frequent cause of this complaint is exposure to cold and moisture; and it is, therefore, most apt to occur in the cool damp weather of the spring and autumn. In some persons, the slightest partial application of cold to any part of the body, when they are warm or perspiring, is sufficient to produce it. There is reason to believe that it may arise from the reaction which follows the direct effect of very cold air upon the fauces. Irritating or corrosive substances swallowed, and acrid eructations from the stomach, also occasion it. The inflammation appears sometimes to be of the nature of rheumatism or gout, as it alternates with these affections elsewhere. It is often sustained, especially in its chronic forms, by disorder of the stomach, irritation being propagated by sympathy from that organ, or kept up by acrid eructations. Hence, in these forms, it is very common among professional men of sedentary habits. The tuberculous or scrofulous diathesis sometimes probably contributes to give obstinacy to the disease. The acute disease occurs at all periods of life, but is most frequent with the young.

Treatment.—If taken at the commencement, this complaint may usually be cut short by a dose or two of sulphate of magnesia, or other saline cathartic, abstinence from animal food, and the use of a gargle made by dissolving alum in water in the proportion of 15 or 20 grains to the fluidounce, and employed twice daily. For persons in whom the disease is apt to end in laryngitis or bronchitis, it is highly important to obtain this result.

At a more advanced period, or in severe cases, this treatment will not always succeed, and alum appears sometimes to aggravate the inflammation. In such cases it may be advisable, if there be fever and headache with a strong pulse, to take blood from the arm. An active saline cathartic every day or every other day, with the use of refrigerating diaphoretics, as the neutral mixture and tartar emetic, may also be usefully employed. Emetics have been recommended; but, though occasionally beneficial, they are unnecessarily violent, and are not often used. The diet should be strictly vegetable; and liquids or soft substances, as mush, are preferable to solid food. Should the general powers of the system be very feeble, and the attendant fever of a typhoid character, which, however, is a very rare event, the depletory treatment should be very moderately employed, or altogether avoided; and it might even become necessary to resort to stimulation. When the disease is associated with acidity of stomach, small doses of magnesia frequently repeated will be found useful; and I have known a purgative dose of calomel effectual in cases complicated with hepatic derangement.

Externally, rubefacients, such as the liniment of ammonia, the tincture of Cayenne pepper, oil of turpentine, or sinapisms may be employed; the neck being guarded against the cold by a piece of flannel around it. Leeches, however, applied beneath the ears or under the jaw, will be found the most effectual external remedy; but, when there is much fever, they should be preceded by venesection. In obstinate cases, blisters on the sides or back of the neck may be resorted to; but they are seldom necessary.

The most appropriate applications to the inflamed parts are mucilaginous, or very mild astringent gargles. Infusion of flaxseed, slippery elm, or sassafras pith, and decoction of marsh mallow are, perhaps, the best. Sage tea, infusion of galls, decoction of oak bark or pomegranate rind, and solution of acetate of lead in the proportion of two grains to the fluidounce, or of alum with five grains to the fluidounce, may also be employed, and may prove useful by facilitating the discharge of the viscid mucus, and even diminishing the inflammation. If, however, they increase the discomfort of the patient, they should be omitted. Very frequent gargling should be avoided as productive of too much movement in the inflamed parts. A strong solution of nitrate of silver, and powdered alum applied directly to the part by blowing through a tube, will often effect speedy cures; but they are seldom necessary.

It is advisable that the patient should speak little, should resist the disposition to frequent hawking and swallowing, and should keep the head as much as he conveniently can in an erect position.

In the rapid and violent cases described by Dr. Todd, all depletion should be avoided, nitrate of silver should be applied to the fauces, and the strength of the patient supported by the use of sulphate of quinia, wine, and rich soups, or, if deglutition is quite impossible, by the injection of the same remedies into the rectum. By this method Dr. Todd thinks that the cases can generally be saved, if taken in time.

In the *chronic* disease, astringent and caustic applications to the inflamed membrane are among the most effectual remedies. Should weak solutions of acetate of lead, sulphate of zinc, alum, and nitrate of silver, employed as gargles, fail, very strong solutions of the same salts may be applied by means of a camel's-hair pencil, or of a stick having a piece of sponge attached to it, or a narrow strip of old linen wrapped several times round one end of the stick, with its edge projecting. Of these salts the most effectual is perhaps the nitrate of silver, which may be used even in the solid state in very obstinate cases; great care being taken that none of the caustic breaks off, and escapes into the stomach, or lodges in the throat. The mineral acids, more or less diluted, have been recommended for the same purpose. Dr. A. P. Merrill, of Memphis, employs with great advantage a liquid consisting of a drachm of iodide of potassium, half a drachm of iodine, half an ounce of syrup, and an ounce of water, which he applies by means of a large camel's-hair pencil. (*N. O. Med. and Surg. Journ.*, ix. 151.) This direct method of local application must be used in all cases when the pharynx is affected. At the same time, external irritation may be kept up by blisters, or pustulation with croton oil or tartar emetic. But all local measures sometimes fail, unless assisted by remedies addressed to the system. Disorder of the stomach should be corrected by antacids, tonics, a properly regulated diet, or other appropriate means. A small dose of magnesia daily is often very useful. Constipation or diarrhœa should be obviated, hepatic derangement corrected by alterative doses of mercurial pill or calomel, and, in general, all such measures adopted as may be necessary to restore and sustain health. When there is reason to suspect a gouty taint, wine of colchicum may be employed with the other remedies. A long journey, or a voyage and residence for a short time in a foreign climate, are often found effectual. The chronic from of the disease is not unfrequently a source of great trouble, especially when associated, as it very often is, with a similar affection of the larynx; and the physician is urgently pressed to afford relief. When other means fail, mercury may be employed with reasonable hope of benefit. In scrofulous cases, recourse may be had to cod-liver oil, or the preparations of iodine.

In the relaxed and edematous condition of the uvula which follows acute inflammation, or attends the chronic form of it, the astringent gargles above mentioned may be used, or stimulant substances, as powdered pepper, ginger, or tincture of capsicum, applied directly to the part. A piece of catechu kept constantly in the mouth, and allowed slowly to dissolve, is also highly useful. When the uvula is hypertrophied, and resists measures for reducing its size, it should be amputated, if productive of any unpleasant effects.

2. PSEUDO-MEMBRANOUS INFLAMMATION OF THE FAUCES.—*Membranous Angina.*—*Angina membranacea.*—*Diphtheritis.*—This is characterized by the exudation of fibrinous and albuminous matter, in the form of pellicle, upon the surface of the membrane, underneath the epithelium. Its precise nature was first satisfactorily shown by Bretonneau, from whom it received the name *diphtheritis*, derived from the Greek *διφθερα*, skin or hide.

Symptoms.—The disease commences with some redness of the fauces and uneasiness, such as occur in ordinary sore-throat, but usually in a less degree. This condition lasts but a very short time, before the exudation commences; and, when first seen by the physician, the surface almost always exhibits small, irregularly circumscribed, whitish, yellowish-white, or ash-coloured patches, sometimes seated in a portion only of the fauces, sometimes scattered here and there over almost their whole extent. These patches bear no inconsiderable resemblance to superficial sloughs, or to the surface of ulcers, for both of which they have not unfrequently been mistaken; but it has been shown, by the most careful microscopic observations, that they consist of a concrete exudation similar to false membrane, and that the surface of the membrane beneath them has not necessarily undergone any loss of substance. In some instances, they are translucent. Their consistence is various, occasionally pultaceous, but more frequently somewhat dense and even tough. The membrane around them is inflamed and reddened, and the tonsils are usually more or less swollen, as are frequently also the cervical and submaxillary glands, and sometimes even the parotids.

In mild cases, such as often occur sporadically, the patches are few, more regularly circumscribed than in the severer forms, and not disposed to spread; while there is little tumefaction either of the tonsils or the external parts, and little or no fever. They are apt, however, to be attended with much pain in swallowing. In the severer cases, the patches spread with greater or less rapidity, sometimes in the course of a few hours coalescing and covering the whole fauces, but more frequently advancing rather slowly, and leaving portions of the membrane uncovered. There is commonly more of the exudation on one side than on the other; and on that where it is most abundant, the swelling of the tonsils and external parts is greatest. The deglutition now becomes more difficult, and liquids often return by the nostrils in attempts to swallow. The patches, soon after they are completely formed, begin to be removed, sometimes separating in strips, sometimes softening and mixing with the fluids of the mouth, and in a few cases disappearing by absorption. They are often renewed, occasionally several times, each time becoming whiter and thinner, till at length they leave the surface covered with a puriform mucus. The process of separation usually lasts eight or ten days. (*Guersent.*) During its progress, it is attended with the discharge of some blood, and copious vitiated secretions, which occasion much hawking and spitting, and have a very offensive odour. There is often also a flow of extremely fetid sanies from the nostrils, indicating the extension of the disease to the nasal passages. The odour of the discharges in these cases has tended to confirm the erroneous idea, that the disease is essentially gangrenous. In the course of the complaint, the disposition to exudation often travels downwards, and the larynx, trachea, and even bronchia, become lined with false membrane, which obstructs respiration, and often leads to fatal results. This extension of the disease constitutes, indeed, its chief danger. It may come on at any period from the first appearance of the patches to the seventh or eighth day (*Guersent*), and is indicated by those changes in the voice and respiration which characterize pseudo-membranous croup. (See *Pseudo-membranous Croup.*) A distinguishing character of this diphtheritic affection, showing that it is connected with the state of the system at large, or of the blood, is that it is disposed to appear on all other surfaces which may be excoriated or suppurating. (*Arch. Gén.*, 4e sér., xxii. 281.)

When the local affection is considerable, the system is brought into sympathy, and fever is developed. The stomach is sometimes irritable, and the bowels, though at first generally disposed to constipation, are apt, towards the close of the disease, to be affected with a fetid diarrhœa. Both of these results are ascribable to the acrimony of the liquid secreted in the fauces, more or less of which is swallowed. In good constitutions, the fever is usually sthenic; but sometimes, especially when the disease prevails epidemically, it has a typhoid or malignant character; and this condition of the system reacts on the local affection. In the former case, the inflamed membrane is bright red, the patches white and of a firm consistence, and the pulse full and strong. In the latter, the membrane, when visible, is purplish or livid, and the exudation yellowish or ash-coloured, or darkened by the bloody liquid effused, and often of a soft pultaceous consistence. The discharges from the mouth and nostrils are excessively acrid and offensive, and often mixed with a dark blood which oozes from the fauces, and even from the gums and lips. Occasionally, obstinate hemorrhage from the nostrils takes place. The pulse is rapid and feeble; the delirium of the early stages is succeeded by coma; and the whole system is in a state of great prostration. Between the two conditions here presented there are various grades, in which their characteristic symptoms are more or less mingled or modified. In the malignant cases, the system is probably under some poisonous influence superadded to that of the local affection. Such cases are happily rare.

The diphtheritic exudation differs decidedly from that of thrush, and in some points also from that which accompanies scarlet fever. In the thrush, the white coating appears first in separate points which afterwards coalesce; is formed upon the surface of the epidermis, or at least not beneath it; may be readily removed without affecting the integrity of the mucous membrane, or causing the least hemorrhage, and, when examined under the microscope, is found to contain abundantly a peculiar fungous plant. The diphtheritic exudation forms in patches, beneath the epidermis; adheres strongly to the membrane, so that it can rarely be detached without causing the extravasation of some blood; and under the microscope exhibits the ordinary constituents of false membrane; namely, interlacing fibrils, molecules or granules, and exudation or pus corpuscles. The exudation in scarlatina occurs generally first in points like the thrush, is much less cohesive than the diphtheritic, less adherent to the mucous membrane, much less disposed to spread into the larynx, and also less disposed to make its appearance upon surfaces elsewhere that may be excoriated. (*Empis, Arch. Gén.*, 4e sér., xxii. 284.)

The duration of the disease, when severe, is usually two or three weeks or more. Except in its malignant form, or when it occurs in constitutions previously much enfeebled, or assumes the character of pseudo-membranous croup, the prognosis is favourable.

Causes.—The causes of ordinary angina will give rise to the pseudo-membranous variety in those predisposed to it. What constitutes this predisposition, however, is not known, although it is probably ascribable to some peculiar inflammation, or attends the chronic form of it, the astringent gargles above mentioned may be used, or stimulant substances, as powdered pepper, ginger, or tincture of capsicum, applied directly to the part. A piece of catechu kept constantly in the mouth, and allowed slowly to dissolve, is also highly useful. When the uvula is hypertrophied, and resists measures for reducing its size, it should be amputated, if productive of any unpleasant effects.

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The exterior local treatment is not very important. Leeches may be used, as an adjuvant to the lancet, or as a substitute for it in doubtful cases; and recourse may be had to rubefacients and blisters, as mentioned under the head of common inflammation of the fauces.

By far the most important remedies are those addressed immediately to the part affected. By these the peculiar character of the inflammation, upon which its danger chiefly depends, may be changed; and, if the disease has not already reached the larynx, its progress may be arrested. In the slighter forms, a solution of sulphate of zinc containing fifteen or twenty grains of the salt in a fluidounce, applied daily or twice a day to the pseudo-membranous patches, will be found sufficient. When a stronger impression is required, caustic substances must be employed. Of these the best is nitrate of silver, which may be applied either in the solid state, or dissolved in six or eight parts of water. Muriatic acid is highly recommended by some writers, and in the worst cases is used undiluted. In those of slower progress, it may be diluted more or less according to the impression desired. Alum is another very efficient application. It is used in saturated solution, or in the form of a very fine powder, which is applied directly to the part by blowing it through a tube adapted to the purpose. These substances should be allowed to come in contact, as little as possible, with any other part of the surface than those covered with the exudation. The liquids may be applied by means of a large camel's-hair pencil, or of a piece of sponge or soft linen attached to the end of a stick. In the intervals between the caustic applications, mucilaginous gargles, sweetened or not with honey of roses, may be beneficially used. A gargle, made of a fluidrachm of chlorinated soda and four fluidounces of water, is recommended in cases attended with fetid discharge. Howard's calomel, applied to the diseased surface by means of a tube, was advised by Bretonneau; but its chief advantages are probably derived from the portion of it which may be swallowed. For the local treatment of those cases in which the disease has entered the larynx, the reader is referred to pseudo-membranous croup and chronic laryngitis.

3. ULCERATIVE INFLAMMATION OF THE FAUCES.—*Ulcerated Sore-throat.*—Ulcers in the fauces are an occasional result of common angina, especially in its chronic state, and are attendants upon various constitutional affections both acute and chronic, as scarlatina, smallpox, syphilis, and the mercurial action. But they sometimes also occur as an original disease, at least they are present when the case first comes under medical notice. It is highly probable that many of the cases, commonly considered as ulcerative, may be really examples of pseudo-membranous inflammation; but this is certainly not the case with others, as, after the removal of the whitish surface which they at first present, an actual loss of substance is observed.

Attention is first called to the throat by the occurrence of a sharp pain in swallowing; and, when the fauces are examined, one or more roundish or oval whitish spots exhibit themselves, surrounded by a red and inflamed margin. The pain which they occasion upon any movement of the fauces is sharper than that of ordinary angina, though there is less heat or uneasiness in the interval. The sensation is like that produced by something sharp sticking in the part. The spots sometimes remain very nearly of their original dimensions, sometimes spread considerably. The whitish matter after a while disappears, leaving a red, excavated, somewhat irregular surface, which in healthy constitutions speedily rises to the proper level and cicatrizes. In some instances, there is a complete absence of febrile action; in others, fever occurs, and in this case the pulse is apt to be very frequent, as in scarlatina, to the milder forms of which the affection bears a considerable resemblance, except in the absence of the eruption.

The general treatment is essentially the same as in ordinary angina, though depletion is much less efficient, and bleeding seldom called for. Should the ulcers become chronic, iodide of potassium may be employed internally. By far the most efficient remedies are local; and the best of these are solutions of sulphate of zinc, sulphate of copper, and nitrate of silver, applied exclusively to the whitish surface, and continued daily, or twice a day, until the colour is changed to red. The solutions should contain from ten to twenty grains of the salt in a fluidounce. In cases unattended with constitutional disturbance, a cure may be expected in a few days.

4. GANGRENOUS INFLAMMATION OF THE FAUCES.—*Angina maligna.—Cynanche maligna.—Malignant Sore-throat.*—It is very doubtful whether any distinct disease exists which merits this title. There is no doubt that gangrene occasionally attends inflammation of the fauces of all varieties. In common angina, pseudo-membranous angina, and even ordinary inflammation of the tonsils, portions of the mucous membrane, and of the structure beneath it, sometimes lose their life; and true gangrenous sloughs are formed. This result almost always depends either on some pre-existing state of the blood, or of the system in general, predisposing to mortification, or upon some general disease independent of the throat affection, co-existing with it, as in the typhoid forms of fever. In malignant cases of pseudo-membranous angina, the surface beneath the exudation is sometimes covered with a slough, the result of mortification. Thrush and aphthæ occurring in the fauces occasionally become gangrenous; and the infantile affection called *gangrene of the mouth* may have its seat in the same part. Indeed, whenever intense inflammation of the fauces occurs in persons whose health has been depraved by insufficient or unwholesome nourishment, or who are affected by some malignant or typhoid disease, or dark-red or livid eruption, or in whom mortification exists in some other part of the body, we may apprehend gangrene, especially in children. The malignant sore-throat described by Fothergill and Huxham, and by Dr. Cullen under the name of Cynanche maligna, is now generally admitted to be a modification of scarlatina; the local and constitutional symptoms being precisely the same as those which attend the worst forms of that complaint, except that, in some instances, comparatively few, the scarlet eruption is absent. In relation, therefore, to the causes and treatment of this affection, it is unnecessary to say anything in this place; the subject having been sufficiently considered under scarlet fever.

Article II.

INFLAMMATION OF THE TONSILS, or TONSILLITIS.

Syn.—Cynanche tonsillaris.—Angina tonsillaris.—Amygdalitis.—Quinsy.

By these terms is here meant inflammation of the substance of the tonsils, that of the mucous membrane covering it being included under some one of the forms of angina already treated of. Sometimes only one tonsil is affected, but more frequently both.

Symptoms.—The local affection is first indicated by difficulty in swallowing, a sense of heat in the fauces, and a constant uneasiness, which gradually increases until it amounts to severe pain. This often shoots through the ear, and the patient sometimes refers it chiefly to that part. The difficulty of swallowing increases, each attempt being attended with an expressive contraction of the features, and an almost convulsive action of the muscles concerned; liquids are apt to pass into the nostrils; and, in severe cases, when both tonsils are involved, deglutition becomes almost or quite impossible. At the same time, there is a constant disposition to swallow, in order to free the fauces from a tenacious colourless mucus, which is also discharged by frequent hawking and spitting. The voice is much changed, assuming a nasal character, and, when the disease is at the height, is sometimes quite suppressed. The hearing is also frequently impaired, in consequence probably of obstruction of the Eustachian tubes. The respiration is not much affected, unless in very bad cases, with great swelling of the tonsils, when a sense of suffocation is sometimes experienced. Upon being examined, the fauces exhibit at first redness, with some projection of one or both tonsils, which gradually increase in size, and, if both are affected, at length almost or quite touch each other. Their surface frequently exhibits a white concrete matter, in spots or diffused, the result of morbid secretion, apparently from the mucous follicles. The uvula is usually much swollen and elongated, and the soft palate inflamed. There is also almost always external inflammation, with swelling of the cervical glands and the cellular tissue, and so much stiffness of the jaws, that, when the disease is at its height, the mouth can sometimes scarcely be opened. The tongue is heavily furred.

The fever is of the sthenic character, and is often very considerable, with headache, and a full, strong pulse. The rigors with which the fever commences sometimes precede any obvious inflammation of the tonsils for some hours, or even a day; but much more commonly, the general and local affection begin at the same time, or the latter precedes the former. The patient generally experiences great restlessness, with inability to sleep. In some cases, there is little or no fever, and the patient does not lose his appetite throughout the attack.

When the inflammation is slight, or is actively treated, it often ends in resolution; but, under ordinary circumstances, suppuration is the more usual result. The establishment of this process is known by the occurrence of slight rigors, and by the greater softness of the tumour to the touch, which may not unfrequently discover fluctuation. Sometimes an elevated pale spot is seen, indicating a disposition of the abscess to open at that point. At this stage of the disease, the sufferings of the patient are often very great; and the relief obtained by the discharge of the abscess is exquisite. This is hastened by the efforts which the patient makes in coughing, swallowing, or clearing his throat. It often occurs in the night, and the patient falling asleep, wakes in the morning entirely relieved, without being conscious of the time when the change took place. The pus is usually swallowed, though occasionally portions of it are discharged by the mouth. After the opening of the abscess, recovery is rapid. The disease is usually about a week in arriving at its height, though sometimes not more than five or six days, and sometimes as much as ten days or two weeks. In some very rare cases, the abscess has opened externally; and still more rarely the pus has dissected its way down into the lungs, and produced fatal inflammation.

After the relief of the acute symptoms, the tonsils are not unfrequently left swollen and indurated; and this is especially apt to be the case in persons of a scrofulous habit, and in those frequently attacked. Sometimes the tumefaction becomes at length so great as to be seriously inconvenient, producing difficulty of deglutition, and an alteration of the voice. The tonsils, moreover, may come into this hypertrophied condition in consequence of a chronic irritation or inflammation, without any preceding acute symptoms.

Inflammation of the tonsils almost invariably terminates favourably unless complicated with some vice of constitution, which would render inflammation, wherever seated, hazardous. Suffocation is mentioned among its dangers; but this must be very rare, unless the larynx becomes involved. I have never witnessed a fatal case. One, however, is recorded in the *Am. Journ. of Med. Sci.* (N. S., xxiv. 96), which was caused by the pressing downward of the epiglottis, so as completely to close the orifice of the larynx.

Causes.—By far the most frequent cause of this disease is exposure to changes of temperature, especially to partial cold, when the body is warm and perspiring. Hence, the complaint is most prevalent in seasons when the weather is changeable, as in the latter part of autumn and beginning of winter, and in spring. It seems sometimes to be influenced by the epidemic constitution of the atmosphere, and is apt to prevail along with scarlet fever and measles. It not unfrequently occurs in scarlatina and smallpox, though materially modified by the character of the affection. It is less disposed to suppuration, when a mere attendant upon these complaints, than in its ordinary state. Certain individuals are very subject to it, and in these the slightest exposure is often sufficient to bring on an attack. It is not common in infancy, or in advanced life; and those who have been subject to it in youth and adult age, generally cease to be so when they become old.

Treatment.—At the period of the complaint at which the physician is called, it is generally difficult to prevent suppuration, unless by an energy of depletory treatment which may lead to more unpleasant consequences than the disease; and the most copious admissible depletion often fails. It is, therefore, scarcely advisable to aim at effecting resolution, unless in the early stage. The moderate depletion, which will at first often check the complaint, will, at a more advanced period, be found useful by moderating the violence of the inflammation, and consequently diminishing suppuration. This is, therefore, in general, the appropriate treatment. When the pulse is full and strong, the system plethoric, and the head painful, blood should be taken from the arm, and, in severe cases, the bleeding may be repeated. But, if the patient was previously feeble, or has been subject to frequent returns of the complaint, venesection as a general rule is better avoided. A brisk purge of calomel and jalap, or of senna tea with sulphate of magnesia, may be given at first, and the bowels afterwards kept freely open with some one of the saline cathartics. Generally speaking, however, no other cathartic is requisite than Epsom salt. In the intervals, the circulation should be kept down by small doses of tartar emetic, and by refrigerant drinks. Emetics have been recommended; but they have little influence over the progress of the complaint when formed. In the very commencement, they may arrest it, and, in advanced suppuration, may give relief by breaking the abscess; but for the latter purpose other means are preferable. Opium, or the powder of opium and ipecacuanha, should be given at night, in cases of restlessness and want of sleep. The diet should be low, consisting of soft or fluid substances, as mush with molasses, and mucilaginous or farinaceous liquids. When the appetite remains, vegetable broth is usually acceptable to the patient.

Not much can be expected from external local treatment. Leeches, however, may be employed, though less useful than in simple angina. Various rubefacient applications and blisters may also be used, as recommended in that complaint. Perhaps the best external application is an emollient poul-

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tice of bread and milk, flaxseed meal, Indian mush, or mashed potatoes, so large as to embrace the whole throat in front and on the sides.

Gargles are useful only by alleviating the discomfort of the patient, and enabling him to discharge the viscid mucus which lines the fauces. Mucilaginous, acidulous, or slightly astringent liquids, may be employed for this purpose; such as infusion of flaxseed, sassafras pith, or slippery elm bark, vinegar and water, infusion of red roses or of sage sweetened with honey of roses, and a very weak solution of alum. Simple warm water used as a gargle often gives some relief. Scarification of the tonsils has been recommended, as also has bleeding from the ranine vein. There are two remedies which, applied in the early stage of the disease, will often arrest it; namely, powdered alum and nitrate of silver. The alum may be brought into contact with the surface of the tonsils, either by means of the index finger moistened and then touched to the powder, or by blowing it into the fauces through a quill or other tube into which it may have been introduced. The nitrate of silver may be applied in substance, by touching the surface with a stick of it, or in strong solution by means of a camel's-hair pencil. When suppuration has commenced, gargling with warm water, or milk and water, or a decoction of figs in milk, and the inhalation of warm vapour, have been thought to advance it. When fluctuation can be detected by the finger, the abscess should be opened.

In chronic enlargement of the tonsils, occasional scarifications, with the intermediate application of strong astringent solutions, especially that of alum, may be resorted to with some hope of advantage. Repeated leeching, blisters, and frictions with mercurial or iodine ointment have been used, but with no very satisfactory results. Dr. Symonds has found most benefit from the daily application of nitrate of silver, in substance or solution. Tincture of iodine, applied occasionally to the tumour, is said to have effected cures. All these measures, however, are apt to fail; and it is frequently necessary to remove the enlarged tonsils by excision.

Article III.

INFLAMMATION OF THE PHARYNX, or PHARYNGITIS.

Inflammation of that portion of the pharynx which can be seen when the tongue is depressed, belongs to inflammation of the fauces, and has been treated of under that head. When it occurs alone, it is characterized by pain, and the absence of alteration of the voice. Inflammation of the invisible portion is much less common. Its diagnostic symptoms are pain in swallowing opposite to the top of the larynx, and tenderness on pressure from without immediately behind the larynx, without redness in the fauces or change of voice. It is seldom attended with fever, and is not often dangerous. It terminates usually in resolution; but the inflammation sometimes extends to the cellular structure posterior to the pharynx, when suppuration may take place, and an abscess result, extremely dangerous in its consequences. There is nothing peculiar in the causes of pharyngitis. Like inflammation of the fauces, it may be of the ordinary character, or pseudo-membranous, and like it may assume a chronic form. It is to be treated, moreover, in the same way, except that little good is to be expected from gargles.

Abscess of the Pharynx.—Collections of pus form in the cellular structure around the pharynx, in various positions, and from various causes. But the affection here referred to is seated in the cellular tissue posterior to the pharynx, between it and the cervical vertebræ. It is not a frequent, but is nevertheless an important complaint. When behind the upper part of the pharynx, it may be known by a projection in the back of the fauces, visible to the eye when the jaws can be sufficiently opened, and sensible to the finger, which at the same time detects fluctuation. When lower down, it is not so easily recognized. Deep-seated pain in the region of the pharynx, tenderness upon pressure from without, stiffness of the neck, great difficulty of deglutition followed by absolute inability to swallow, suppression of the voice, and the most distressing dyspnœa, attended with laborious efforts to inspire, are symptoms which should lead the physician to suspect its existence, and, if it be invisible, to attempt by the careful introduction of a stomach tube to ascertain whether the passage is closed. The danger arises partly from inanition, but chiefly from pressure upon the larynx, producing suffocation. Several fatal cases are on record; and it is probable that others have occurred, which have been mistaken for laryngeal disease. The chief diagnostic symptoms are the seat of pain, and the inability to swallow. There is usually considerable fever, and sometimes cephalic symptoms, which tend to direct attention away from the real danger. The abscess is more dangerous in the lower than the upper part of the pharynx.

This affection may attend the advanced stage of certain fevers, or may result simply from inflammation of the pharynx. It may also be produced by disease of the cervical vertebræ. As hitherto observed, it has been most common in children under four years; but it may occur at any age.

The treatment consists simply in opening the abscess; and the chief cautions requisite are to avoid making too deep an incision, and to strike as nearly as may be the middle line, so as to avoid any considerable artery. Dr. Abercrombie relates three cases of children, who were apparently rescued from suffocation in this way. Should the abscess be out of sight, and beyond the reach of the finger, the cutting instrument should be sheathed in a tube, until in contact with the tumour.*

Article IV.

INFLAMMATION OF THE ŒSOPHAGUS, or ŒSOPHAGITIS.

This is a very rare affection, unless originating from the direct application of irritating substances, or from mechanical violence.

Symptoms, &c.—A sense of heat and of pain, increased by swallowing, and frequently referred to the lower extremity of the pharynx, or to the cardiac orifice of the stomach, no matter what part of the tube may be affected, is the earliest symptom. Sometimes the pain is felt between the shoulders, or is referred to the larynx. Tenderness upon strong pressure from without is experienced, if the disease is seated in the upper part of the œsophagus. Deglutition is usually more or less difficult, and sometimes impossible. The complaint is said to be frequently attended with hiccough, and sometimes with the eructation of a glairy mucus, and with vomiting. There is usually little or no fever. The inflammation generally terminates by resolution, though suppuration sometimes takes place, and an abscess may form between the mucous membrane and the muscular coat. Ulcers occasionally result. The inflammation may also be of the pseudo-membranous character, in which case it is usually propagated from the fauces or larynx, though it does occasionally originate in the œsophagus, and has been known to occupy its whole extent. The vomiting of flakes, or a tube of false membrane, would lead to the suspicion of its character. In some cases of œsophagitis, the mucous follicles are exclusively affected; but this cannot be ascertained during life. The disease occasionally becomes chronic, in which case we have the ordinary symptoms of the acute in a moderated form, and especially a copious discharge of mucus by the mouth.

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* For an elaborate account of this affection, the reader is referred to an article by Dr. Charles M. Allin, in the New York Journal of Medicine (N. S., vii. 807).

Causes.—The usual causes are acrid, corrosive, or very hot substances swallowed, and mechanical violence from sharp, rough, or hard bodies introduced into the œsophagus, or from undue efforts by the surgeon in the use of the stomach tube, the bougie, or the probang. The disease may also be propagated downward from the fauces, or upwards from the stomach. It has been ascribed, in some instances, to the retrocession of cutaneous eruptions, and of rheumatism. There is little doubt that the muscular coat sometimes becomes the seat of the latter affection.

Treatment.—Venesection when the pulse is strong and excited, saline cathartics, stimulating pediluvia, a liquid farinaceous diet, repeated leeching or cupping, emollient poultices, and, in the advanced stages, blisters upon the neck or between the shoulders, constitute the chief remedies. In chronic cases, revulsion should be sustained by a perpetual blister, by pustulation with croton oil or tartar emetic, or by a seton. Should the case not yield to other measures, mercury should be resorted to; and this should be employed early, if there is reason to believe that the inflammation is pseudo-membranous. When inability to swallow exists, attempts may be made to support the patient by nourishing liquids injected into the bowels.

Article V.

STRICTURE OF THE ŒSOPHAGUS.

1. ORGANIC STRICTURE.—The consideration of this subject belongs properly to the surgeon; as it is by surgical means that relief is to be afforded. A few remarks, therefore, will be sufficient. The complaint is indicated by difficulty of deglutition, at first moderate, but gradually increasing so that the patient can at length swallow nothing but liquids, or ceases to swallow even these, and dies of inanition. Sometimes, however, the stricture continues many years without perceptible increase. It may arise from thickening of the coats consequent upon inflammation, from contraction produced by the healing of an ulcer, from excrescences growing out of the mucous membrane, from cancer, from cartilaginous or osseous degeneration of the tube, or from the pressure of exterior tumours. Among its effects is a dilatation of the œsophagus above the place of stricture, sometimes to a very great extent. When there is much pain, leeching, blistering, and narcotics may be employed. When it originates in inflammation, some advantage may be hoped from a careful course of mercury, or the internal and local use of iodine. Caustic to the strictured part has been employed by some English surgeons; but the only means upon which much reliance can be placed is the use of the bougie.

2. SPASM OF THE ŒSOPHAGUS.—This is a morbid muscular contraction of the tube producing more or less difficulty of swallowing.

Symptoms.—The spasm generally comes on suddenly, often, for the first time, during a meal. Upon an attempt to swallow, the food is arrested, and is either rejected immediately and with force, or is retained for a time, and then rises by regurgitation. The former event is apt to occur when the stricture is near the upper extremity, the latter when it is near the lower. Occasionally, after the food has been a short time in contact with the stricture, this gives way and allows it to pass into the stomach. In some instances, solids can be swallowed better than liquids, and the reverse is sometimes the case; but in general any sort of food is sufficient to excite the spasm when the morbid susceptibility exists. Severe pain often attends the spasmodic action, and the irritation occasionally extends to the larynx or lungs, producing much embarrassment of respiration, with a feeling of impending suffocation. Even where no effort at deglutition is made, there is frequently present a sense of constriction, and, in some cases, a feeling as of a ball ascending in the throat, or moving from one part to the other. This is the globus hystericus of older writers. Hiccough and vomiting sometimes accompany the affection. Its duration is exceedingly various. An attack may consist of a single paroxysm, lasting only a few hours, or the spasmodic action may continue with exacerbations and remissions, and occasional complete intermissions, for months or years. Like most other nervous affections, it sometimes assumes the regular intermittent form.

From organic stricture, the only complaint with which it can be confounded, it may in general be readily distinguished by the suddenness of the attack, by the occasional absence of all the symptoms, so that the patient can swallow easily, and by the other evidences of nervous disorder with which it is frequently attended. A large bougie can also be passed with facility in periods of relaxation, and, even when arrested by the spasm, if held for some time against the stricture, will often be allowed to enter.

Causes.—Irritation of the mucous coat, from whatever cause, may produce the spasm when a predisposition to it exists. It is sometimes excited by inflammation of the œsophagus. Among the causes may be mentioned acrid substances swallowed, cold drinks during perspiration, partial exposure to cold air, violent and depressing emotions, the operation of the imagination, and the influence of disease existing elsewhere, as of dentition, organic affections of the larynx, stomach, and uterus, and inflammation of the upper part of the spinal marrow. The predisposition usually consists in an excitable state of the nervous system, such as exists in hysteria, hypochondriasis, and generally in a debilitated and anemic condition of body.

Treatment.—The indications of cure are first to relieve the local affection, and secondly to correct the predisposition. The first is answered by remedies suited to relax the spasm directly, and to diminish the nervous excitability of the part, so as to prevent the disposition to its recurrence. If inflammation exist, it should be removed by the means already indicated. If the affection be purely nervous, recourse may be had to narcotic cataplasms, as of tobacco, henbane, or hemlock, to acetate or sulphate of morphia upon a blistered surface, to rubefacients, epispastics, pustulating substances, or a seton applied to the back of the neck, and to the internal use of antispasmodics and narcotics, such as assafetida, valerian, Hoffmann's anodyne, camphor, opium, henbane, and hemlock. Much good is said to have resulted from very cold drinks, and even ice swallowed by the patient.

To meet the second indication, remedies must be employed calculated to remove the disease of other organs with which the spasm may be associated, and to correct any existing morbid state of system. These remedies are detailed elsewhere. It is sufficient here to mention that it is usually desirable to invigorate the general health by chalybeates or other tonics, exercise, fresh air, a nutritious diet, the avoidance of coffee, tea, and tobacco as habitual luxuries, and attention to the bowels and the various secretions. Strychnia has been employed successfully in one severe case by M. Mathieu. A complete cure was effected in six weeks. (*Journ. de Pharm.*, 3e sér., xxii. 390.)

In the regularly intermittent form of the complaint, sulphate of quinia will prove effectual.

SUBSECTION III.

DISEASES OF THE STOMACH.

Article I.

INFLAMMATION OF THE STOMACH, or GASTRITIS.

The inflammation in this disease is usually seated in the mucous membrane, and the submucous cellular tissue; though it sometimes extends to the other coats, and may even involve the whole stomach. The peritoneal coat is seldom exclusively affected, unless in cases of general peritonitis, to which disease, therefore, inflammation of that coat properly belongs. Gastritis exists under the two forms of *acute* and *chronic*. Some make an intermediate grade which they call *subacute;* but there is scarcely sufficient ground for this distinction in any peculiarity of character, or precise degree of violence.

Acute Gastritis.—This is not common as an independent affection, though frequently associated with other diseases, of which it may be either an effect, or a mere attendant, having its origin in the same cause. Few organs resist so firmly the ordinary direct causes of inflammation as the stomach, and few are so readily affected through the sympathies. The object of this provision is evident. An organ so important in its functions, and so much exposed to irritant influences from without, would be constantly suffering, and causing the system to suffer, if readily excited into inflammation by such influences; while, if undisturbed by inflammation, or morbid excitement in other organs, it would continue to furnish, through the function of digestion, materials to the blood calculated to sustain the disease.

Symptoms.—In severe cases of acute gastritis, there is usually a burning pain in the epigastrium, with incessant nausea and vomiting, commencing with the attack, and continuing, with greater or less intensity, till near the close. The pain is increased by pressure from without, and by a deep inspiration, and is sometimes excruciating in the act of vomiting. The substances thrown up from the stomach are at first the food or chyme, and afterwards bile or mucus, and whatever may be swallowed, and are sometimes more or less deeply tinged with blood. There is occasionally considerable difficulty of deglutition, in consequence of spasm of the œsophagus or cardiac orifice. The thirst is intense, and the patient is constantly calling for cold water, although, if taken freely, it produces uneasiness and oppression by the distension of the stomach, and is often immediately rejected. The tongue is at first usually covered in the middle and posterior part with a whitish fur, while its tip and edges are red, and red papillæ are visible through the coating; but sometimes it is red, smooth, dryish, and without fur, from the commencement. The bowels are almost always constipated, unless they participate in the inflammation, in which case they are looser than in health. The patient lies on his back, is apt to be low spirited, is restless and wakeful, and has a feeling of great debility, with an expression of face indicating anxiety and distress. The pulse is frequent and sometimes full, but usually small and corded; the respiration often short and hurried; the skin hot and dry;

and the urine high coloured. A hard, dry cough, occasionally paroxysmal, is also mentioned among the symptoms.

Should the disease now take a favourable turn, the pain and vomiting abate; the tongue becomes paler and moister, the pulse slower, fuller, and less corded, the skin cooler and softer; and sometimes a general moisture of the surface, or relaxation of the bowels, evinces that the crisis is passed. But, should it advance unfavourably, the tongue, if before coated, becomes smooth, red, and dry, and towards the close is occasionally covered, as well as the inside of the cheek, with a thrush-like exudation; the skin becomes cool and pale, and the pulse more frequent, feeble, and thread-like; the body emaciates rapidly; debility and restlessness increase; delirium frequently occurs; hiccough harasses the patient; active vomiting is succeeded by mere regurgitation; instead of mucus or bile, a black matter like coffee grounds is sometimes ejected; the tenderness on pressure diminishes, and pain sometimes ceases entirely; the countenance sinks, and assumes a haggard aspect; and death occurs, preceded by cold extremities, a scarcely perceptible pulse, and other evidences of extreme exhaustion. The complete suspension of pain, without amelioration in other respects, is an unfavourable sign. In some rare instances, in the latter stage, the pain suddenly increases and becomes more diffused, and extreme tenderness upon pressure is felt over the whole abdomen, which swells and assumes a tympanitic condition. In such cases, the stomach has been perforated, and peritoneal inflammation has been produced by the fluids which have escaped through the opening. Inevitable death speedily follows this event. When the stomach has been disorganized from the commencement by the violence of the cause, as when one of the concentrated mineral acids has been swallowed, great prostration comes on almost immediately, with a cold, clammy skin, and a very feeble pulse; and death soon takes place.

In milder forms of the disease, the symptoms above enumerated as characterizing the earlier stages, are experienced in a less degree. Sometimes, instead of severe pain, there is merely a feeling of oppression, weight, or constriction; instead of obstinate and incessant vomiting, merely a slight nausea, or a disposition to vomit ingesta. The pulse, too, in such cases, is usually more full and developed. Epigastric tenderness is seldom absent. Occasionally, even in severe gastritis, there is a want of all the characteristic symptoms; so that the first evidence of the nature of the complaint is afforded by dissection. This is sometimes attributable to the fact, that secondary or sympathetic affections, such as severe headache or delirium, pains in the back or limbs, or irritation of some portion of the pulmonary apparatus, become so prominent as to act revulsively in relation to the gastric sensibilities, and thus to mask the real disease. When gastritis attends other diseases, it is peculiarly liable to be thus concealed, as in the delirium of drunkards which immediately follows an occasional debauch, and in which it is highly important that it should be recognized. (*Stokes.*) The duration of acute gastritis is very variable. In violent cases, as from corrosive poison, death, in some instances, takes place in less than twenty-four hours; while in others, the disease continues from two to six weeks, and then, if not fatal, ends in a slow convalescence, or subsides into chronic gastritis of indefinite duration. Milder cases often yield speedily to appropriate treatment; but, if not taken in time, may run on for weeks, and at last assume the chronic form.

Anatomical Characters.—The stomach is more or less contracted, sometimes so as not to exceed the transverse colon in size. The mucous membrane is often much wrinkled, and sometimes covered with a viscid or puruloid mucus, upon the removal of which it exhibits the usual marks of inflammation. The colour is either bright-red, brownish, or livid-red, or blackish-brown, and is more or less diffused over the stomach; sometimes extending over the whole mucous surface, sometimes confined to a portion of it, most commonly the fundus, and usually deepest in this part. The redness may be uniform, in patches or stripes of greater or less extent, or in points, or stellate, or arborescent with innumerable capillary ramifications, or branching with larger trunks. Sometimes it is found of one form in one part of the stomach, and of a different form in another. The darker shades of colour, the brown and black, for example, are, according to Andral, very seldom found in acute gastritis, and only in cases of great intensity and brief duration, such as result from the corrosive poisons. Ecchymosis is not unfrequent, usually in patches, sometimes in isolated spots in the submucous tissue, producing small prominences on the surface. The mucous follicles often exhibit evidence of increased developement in small reddened eminences. The discoloured portion of the membrane is generally thickened, and more or less softened, so that it is more easily torn than in health. Sometimes it is reduced to the state of a soft pulp. These various alterations may be confined strictly to the mucous membrane, or may penetrate one or more of the remaining coats; and Andral relates a case, in which the whole of the coats of the left half of the stomach were in a friable, almost pulpy condition. Eschars are occasionally seen with purulent secretion, œdema, emphysema, and other accompaniments of disorganization, and the consequent vital process of separation, in various states of advancement. Ulcers are rare, as a result of acute gastritis, except in cases of poisoning.

It is highly important, in a toxicological point of view, that the post-mortem evidences of gastric inflammation should not be mistaken. It was at one time generally supposed that redness was a sufficient indication; and it was taken for granted that any stomach which presented this appearance had been inflamed. Yellowly, however, by experiments made in 1813, satisfactorily proved that stomachs, previously in a healthy state, often appeared much reddened after death; and observations, made since that period by Andral and others, go to show that no modification of colour alone can be admitted as certain proof of inflammation. All the varieties of shade, and all the diversities of arrangement above stated, may result from causes wholly independent of that condition. Not to mention irritation, or mere healthy excitement, which often occasions intense redness of the mucous membrane, the same effect is produced by congestion of the portal circle, or any other cause obstructing the return of blood from the stomach, and by agencies operating at the time of dissolution, and after death, particularly gravitation, which causes the blood to settle in the most dependent parts of the stomach. The fact, moreover, should be borne in mind, that the gastric mucous membrane, in very young subjects, is of a rosy hue in health. Even softening of the membrane cannot always be relied on; as it may be entirely cadaveric, resulting from the action of the gastric juice, or from incipient putrefaction; and, in very low states of the system, the vital properties may be so much enfeebled in parts which have become the seat of a passive sanguineous congestion, that the chemical forces may predominate, even during life, and produce a material change of consistence. It should also be remembered that the healthy consistence of the membrane is different in different parts, being firmer near the pylorus than in the remainder of the stomach. Notwithstanding these difficulties, however, there is usually, in cases of real inflammation, abundant evidence of its having existed, in the state of the stomach after death. The facts just mentioned should only serve as a caution not to mistake, for proofs of inflammation, appearances which may have had a wholly different origin.

Causes.—Acute gastritis is rarely produced by those vicissitudes of temperature which are so often the cause of other inflammations. It most frequently results from caustic or irritant substances taken into the stomach. The corrosive mineral, and acrid vegetable poisons often prove fatal in this way. Milder stimulants, such as alcoholic drinks, the stronger condiments, and even an excess of food, sometimes produce acute inflammation of the stomach, but rarely unless in cases where a strong predisposition exists. Large draughts of very cold water after fatiguing and exhausting exertion, when the body is heated and perspiring, are among the causes. Very severe cases sometimes result from the translation of acute gout or rheumatism. Andral relates a striking case of this kind, in which a predisposition to disease of the stomach appeared to be occasioned by distress of mind. But the state of convalescence from certain acute diseases, especially cholera, and the previous existence of chronic inflammation of the stomach, constitute the strongest predisposition. It is in these conditions, that excess in eating and drinking most frequently brings on an attack of acute gastritis.

But this disease occurs much more frequently as an attendant upon other diseases, than as an original or independent affection. It is peculiarly apt to occur in the course of idiopathic fevers, particularly in the bilious remittent and yellow fevers, and not unfrequently also attends the exanthemata and phlegmasiæ. It is sometimes lighted up in the advanced stages of phthisis. In some instances, it is very difficult, nay impossible to decide, whether the gastritis be the original, or a secondary affection. The decision, however, is of the less consequence; as, in either case, a prominent indication would be to combat the disease of the stomach; as this is at least one of the chief sources of danger.

General Treatment.—Should the gastritis have been caused by a corrosive or acrid poison, and the stomach not yet fully evacuated, the first object in the treatment should be to remove the offending matter, either by means of copious draughts of warm water, or other bland liquid, or, if these should be insufficient, by means of a gentle emetic of ipecacuanha accompanied with free dilution. At the same time, substances should be administered calculated to act as antidotes by neutralizing the poison; and, after the stomach has been thoroughly cleansed, castor oil or sulphate of magnesia should be given along with the antidote, in order to evacuate any portion of the poison which may have passed into the bowels. The inflammation is then to be treated as if it had arisen from other causes, attention being always paid to whatever peculiar condition of the system may have arisen from peculiar properties in the poison, and to the fact, that, if great organic injury has been inflicted, the system is too much prostrated to admit of copious depletion.

In the early stage of gastritis, if the patient has not been previously debilitated, and the system is not under the influence of some powerfully depressing agent, as in typhus fever, and the case of certain poisons, blood should be taken freely from the arm; and, if the pulse and general strength do not fail under the loss, the bleeding should be repeated once and again, until a decided impression is made on the disease. The pulse and muscular strength of the patient are not to be taken as exclusive guides in acute gastritis. They both feel the depressing influence of the attending nausea, and will often rise under depletion, in consequence of the diminished force of the disease in which the nausea originates. Besides, a certain energy of stomach seems necessary to support the actions of the circulatory system, and, when the functions of that organ are wholly suppressed by excessive inflammation, the heart, though irritated, contracts with comparatively little force. Diminish the inflammation, and the heart resumes its power. Venesection is safe, so long as the pulse, as it not unfrequently does, rises and becomes more developed under the lancet.

As constipation is an almost uniform attendant on uncomplicated gastritis, cathartics would appear to be indicated; but medicines of any kind taken internally are apt to be rejected, or to aggravate the inflammation; and most authors recommend either their very sparing employment, or a total abstinence from them. Nevertheless, from five to fifteen grains of calomel may often be usefully given, in the earlier stage, after the due loss of blood. This cathartic is but slightly if at all irritant to the inflamed membrane, and is sometimes retained with the effect of calming the stomach, when other substances, even small quantities of cold water, are rejected. Besides, it operates favourably by unloading the portal veins through the secretion of bile, and thereby diminishing congestion in the stomach. The bowels should afterwards be kept open by the frequent use of enemata. In some cases, when medicines are tolerated, a little castor oil or carbonate of magnesia, or other mild cathartic, may be administered with advantage; but, if found to disturb the stomach, they should not be persevered in. The effervescing draught will often operate favourably by promoting perspiration and reducing fever; but this also will sometimes prove irritant, and must be relinquished. Opium, or one of the salts of morphia, may be given when the first violence of the inflammation has subsided. A full dose may be administered at bedtime, and repeated in an hour or two if it should not procure rest. Calomel may often be usefully combined with the opium, and, if the disease does not appear disposed to yield to depletion, may be repeated at such intervals as to bring the system carefully under the mercurial influence. Half a grain or a grain of opium with one or two grains of calomel, in the form of pill, repeated every four, six, or eight hours, will generally be sufficient for the purpose. When the vomiting is obstinate, and easily excited, so that even these medicines cannot be retained, advantage will accrue from enemata of laudanum with a solution of starch or flaxseed tea. Throughout the complaint, stimulating pediluvia, or other measures for exciting action in the lower extremities, should be employed when these are pale and cold. In the last and most prostrate stage, when the symptoms indicate threatened or existing gangrene, the most efficient remedy is oil of turpentine with laudanum or a salt of morphia, given frequently in small doses. I have seen one apparently desperate case recover, under the use of this combination.

The patient should not be allowed to drink largely; but he will derive relief from occasionally swallowing a mouthful of very cold water, or from keeping ice in his mouth, and swallowing it as it dissolves. Few measures will be found more grateful than this, while it proves positively useful in the relief of the inflammation. Stokes recommends that small pieces of the ice should be swallowed undissolved, after they have remained in the mouth a short time, so as to round off the angles. Iced lemonade, or carbonic acid water may sometimes be favourably substituted for pure water. In the early stages, no other nutriment should be allowed than a solution of gum arabic, weak barley-water, or some other mucilaginous or farinaceous drink; and even these may be dispensed with at first; but, in the more advanced stages, when the debility is great, and an absolute necessity exists for the support afforded by nourishment, fresh milk mixed with lime-water will be found both grateful and useful. These should be given in small quantities frequently repeated, as from half a fluidounce to a fluidounce of each every hour. In a still more advanced stage, chicken broth, plain cream, or ice cream may be carefully administered. In convalescence, the utmost caution should be observed to guard the patient against imprudence in eating, as nothing would be more likely to occasion a relapse.

Local Treatment.—No one remedy in the treatment of acute gastritis is more important than leeches to the epigastrium. These should be resorted to after bleeding, and immediately in cases where bleeding is deemed unnecessary or inadmissible, and should be repeated occasionally until the symptoms give way. The most decided relief is often experienced from this remedy, in some instances even while the leeches are drawing. Some writers recommend them to the exclusion, or nearly so, of general bleeding; but I am convinced that this is a great mistake. The principle upon which leeching operates with so much advantage is not obvious. Some refer it to revulsion, and the direction of the current of blood from the stomach to the surface. But in this way the leeches should prove equally useful applied to the sides or back, as these parts are nearer even than the epigastrium to the source whence the stomach receives its supply of blood. May not the result be ascribed to some undefined sympathy between the epigastrium and the gastric mucous membrane? In the intervals between the leeching, warm fomentations, or light emollient cataplasms should be applied over the region of the stomach, unless found very oppressive by their weight. Care, however, must be taken that they do not produce too copious a flow of blood from the leech bites. Cold applications, and even ice, have been recommended as preferable to warm fomentations; but I can say nothing of this remedy from experience. In the advanced stages, decided benefit will sometimes accrue from blistering, and advantage may be taken of the raw surface thus obtained, to hasten a mercurial impression by applying dressings of mercurial ointment, or to relieve nausea and vomiting by the endermic use of the acetate or sulphate of morphia.

It is scarcely necessary to state that the above plan of treatment may be applied, in various degrees, and with various modifications, according to the nature of the case, as well to the inflammation of stomach which attends other diseases, as to idiopathic gastritis.

Chronic Gastritis.—There is no distinct line of division between this and the former variety of gastritis. The extremes could not be confounded; but of the numerous intermediate grades, it would often be difficult to decide which might belong to the one, and which to the other variety. If the practitioner, however, observe the same gradation in the treatment, which he finds in the character of the disease, no harm can result.

Symptoms.—When not the result of the acute form, chronic gastritis in general approaches so gradually that it seldom attracts the serious attention of the patient, or comes before the notice of the physician, until it has existed a considerable time. The first symptoms are usually some uneasiness in the region of the stomach after eating, more or less derangement of the appetite, and a feeling of general discomfort during digestion, with occasional headache, and vague pains or soreness in the limbs as if from fatigue. Sometimes nausea and vomiting occur at the commencement. The symptoms gradually increase in intensity and diversity; and the disease puts on a great variety of aspects, dependent on the degree, extent, stage, cause, and character of the inflammation, the tissue or part affected, the constitution and habits of the patient, and the almost infinite diversity of sympathetic derangements. In almost all cases, perhaps in all, there is more or less epigastric uneasiness. This generally amounts to pain, which, however, is exceedingly variable, being sometimes acute, lancinating, or spasmodic, sometimes slight, dull, and little more than soreness. Frequently there is a sense of heat or burning, which sometimes extends up the œsophagus, or over the chest, particularly on the left side, and is hence called *heartburn.* Instead of pain, there is often a feeling of fulness and distension, or of weight, or constriction, or of gnawing at the epigastrium, which is for the most part also, though not invariably, sore when pressed. The uneasiness is sometimes general over the epigastric region, or even extends under the ribs on both sides, and under the sternum; but, in other cases, it is shifting, or confined to one spot; and this occasionally answers to the particular part of the stomach affected. Frequently also pain is felt in other places, as in various parts of the chest, in the shoulder and arm, and in the back immediately behind the region of the stomach. The sensation is seldom constant; but has exacerbations and remissions, or entirely intermits, and is generally worse immediately after eating, or during digestion. It sometimes commences at a certain period after a meal.

The appetite is variable in different cases, and sometimes in the same case. Occasionally it is little affected; and, in such cases, there is reason to think that the inflammation is confined to a comparatively small portion of the stomach. Very generally, however, it is deranged, for the most part diminished, sometimes nearly or quite lost, and occasionally craving. In the last case, though the patient may begin to take food eagerly, yet the disposition is apt to pass away after a small portion has been swallowed, and is even followed by a feeling of disgust. Instead of a genuine appetite, there is often a sensation as of hollowness or sinking at the stomach, with a feeling of faintness, which leads to the desire for food, and is sometimes relieved by it. The same want of the system is, in some instances, expressed by a headache or dry cough, which ceases after a meal. The patient sometimes dreads food from the remembrance of the uneasiness it has occasioned. The taste is often vitiated, and substances leave an impression of sourness in the mouth after being swallowed. There is usually thirst, with a desire for cold drinks, which, if moderately taken, afford relief; while hot and stimulating drinks increase the uneasiness. Sometimes, however, the thirst is not greater than in health.

Large quantities of gas are sometimes evolved in the stomach, which occasion frequent belching. The gas is in some instances inodorous, in others fetid and irritating. Eructations of sour and acrid liquids are not uncommon. Vomiting is also a frequent attendant. It occurs seldom at the commencement of the attack, but is apt to become more frequent, and at length, in some cases, attains such a degree that not a meal, and scarcely a mouthful of food can be swallowed without being discharged. It is wonderful how long patients sometimes live, and even retain their flesh, who vomit apparently all their food. Portions, however, must remain and be digested. The matters vomited are food, bile, mucus, sour and acrid liquors which seem to excoriate the throat in their passage, and, in some instances, blood mixed or unmixed, fresh or altered by the action of the gastric juice. Sometimes, especially in the latter stages, and when ulceration exists, a dark matter resembling coffee-grounds is discharged from the stomach, and is also found in the alvine evacuations. This is blood somewhat modified either in its passage through the epithelium, or by the chemical action of the gastric liquids. The discharge of these various substances often affords so much relief to the patient, that he acquires the injurious habit of throwing them up voluntarily. In some cases, large quantities of a glairy fluid like the uncoagulated white of eggs, or of the ordinary mucus of the stomach, or of a tasteless colourless liquid like saliva, are discharged, often rather by a species of eructation than by vomiting.

Constipation almost invariably exists, unless in cases in which the inflammation extends to the bowels.

The tongue is, in some rare cases, little if at all affected; but generally it is either coated more or less with a whitish or yellowish fur, with the reddened papillæ projecting, or is red and smooth, or has the papillæ enlarged and reddened without other change. It is seldom so dry as in acute gastritis, but is often clammy or dryish, especially in the morning, or after sleep. In the advanced stages, it is occasionally covered with aphthæ, or a thrush-like exudation. This is supposed to indicate ulceration of the stomach, and is usually an unfavourable, though by no means necessarily a fatal sign.

The pulse is sometimes scarcely more frequent than in health, and may even be less so. Occasionally it is irregular and intermittent. Usually, however, it is somewhat increased in frequency and tension. In some instances, there is a slight febrile paroxysm after eating; and, in the advanced stages, the pulse often becomes very frequent, and even hectic fever may set in. Except in this lattter state, the skin is almost invariably dry, and sometimes even harsh, with a disposition to eruptive affections of various kinds, especially urticaria. The soles of the feet, and the palms of the hands, are in some persons distressingly hot; while in others there is a disposition to coldness of the extremities.

The secretions are almost always more or less deranged. The saliva is not unfrequently sour, the bile scanty, superabundant, or deranged, and the urine variously disordered.

The nutritive process is differently affected in different cases. Sometimes the patient appears not to lose flesh for a considerable time after the commencement of the disease, and, in a few instances, retains his fulness till near the close. But usually there is great emaciation.

The sympathetic disorders of the nervous system are almost infinitely numerous and diversified. Among the more common may be enumerated headache, giddiness, perverted vision, muscæ volitantes, buzzing or roaring in the ears, dyspnœa, a dry hard cough, palpitations, violent pulsations in the epigastrium, a general feeling of uneasiness, vague pains in the extremities, and great mental anxiety or dejection, with perverted feelings, and notions amounting sometimes to hypochondriasis.

The duration of the disease is usually considerable, not unfrequently for years. It seldom marches steadily forward, but is liable to frequent changes; the patient sometimes approaching to recovery and then relapsing, and going through this alternation several times before recovery or death. Under favourable circumstances of position, constitution, and treatment, the disease very generally terminates favourably, unless complicated; and the patient sometimes recovers from the most alarming symptoms. Even large ulcers heal. But death is not an unfrequent result. It is usually preceded by great emaciation and debility, sometimes by hectic fever; and the patient often sinks under a complication of visceral affection, originating in sympathy with the stomach, but constituting ultimately the chief source of danger. The fatal result is sometimes immediately produced by an attack of peritonitis, consequent upon the escape of the contents of the stomach, through an ulcerated opening, into the cavity of the abdomen. The ulcer having destroyed nearly the whole thickness of the coats, the remaining slender portion is ruptured by some mechanical violence, as by over-distension of the stomach, the act of vomiting, or by voluntary straining. The penetration, however, of the coats of the stomach is not necessarily fatal. The diseased surface may contract adhesions with that of an adjacent viscus, the body of which thus forms a floor for the ulcer. The liver, spleen, or pancreas may serve this useful purpose. Sometimes the stomach and colon become united, and communicate so that the contents of the former escape through the latter. These results, however, are more common in cancer of the stomach than in ordinary ulceration.

It has been mentioned that numerous varieties of chronic gastritis exist.

Sometimes the symptoms are comparatively mild from the commencement, and continue so through its whole course. In other cases, though mild in the beginning, and for a variable length of time afterwards, they gradually increase until the case assumes a serious aspect. In others again, they exhibit an alarming intensity almost from the outset. In a few instances, the complaint runs on in its mildest form for a long time, and then suddenly breaks out into fatal violence. Under such circumstances, there is reason to suppose that the inflammation may have been confined to a small portion of the stomach, but, ending in ulceration, exhibits at length evidences of great organic mischief. This condition may be suspected when vomiting of blood, or of matter like coffee-grounds, supervenes upon the ordinary symptoms of chronic gastritis. The inference, however, is by no means positive; as both these results may occur without any solution of continuity in the mucous membrane. Perforation of the stomach is another of those cases in which the course of the disease is very insidious. Every now and then a case occurs, in which the patient, previously in tolerable health, or complaining occasionally of some stomachic uneasiness, is suddenly seized with severe pain, and dies with all the phenomena of peritonitis. Dissection reveals an ulcerated opening in the stomach. It is desirable, in reference to treatment, to be able to diagnosticate those cases of deep solitary ulcers, which are most apt to end in perforation. Such a condition may be suspected when a patient, with little constitutional disturbance, complains of almost constant pain in a particular point of the stomach, increased after eating, with sour eructations, occasional vomiting, and perhaps the discharge of blood, though these latter symptoms are not essential. Another variety of the disease is so peculiar as to merit a separate paragraph.

Under the name of *gastrorrhœa*, modern writers describe an affection, characterized by the copious discharge from the stomach of a glairy fluid, usually insipid and inodorous, bearing a close resemblance in appearance to the uncoagulated white of eggs, or of mucus in its ordinary form. The vomiting occurs most commonly in the morning, as if the fluid had collected in the stomach during sleep; but it may take place at any time; and a singular circumstance is, that the matter is often thrown off after eating, without a simultaneous discharge of the food. The vomiting is usually very easy, sometimes in fact little more than a species of regurgitation. The disease may be considered as a sort of catarrh of the stomach. It is sometimes attended with the ordinary phenomena of chronic gastritis; but, in other cases, neither exhibits during life, nor leaves after death, evidences of inflammation. Still, like the similar affection of the nostrils and the bladder, it probably originates, even in the latter cases, in an inflammatory condition, or at least irritation of the mucous membrane, which has given way to the discharge, while the mucous follicles continue their disordered mode of action. It is often a mild disease; but, in some instances, runs a long course, and at last ends fatally, especially in old persons.

Anatomical Characters.—The portions of the mucous membrane which had been inflamed usually exhibit a brown, grayish-slate, or blackish colour, arranged in the different modes mentioned under acute gastritis. The colour is sometimes, though rarely, red. In some instances innumerable minute black points are seen, so close together as to give the whole surface of the membrane a black or dark-gray appearance. When examined by the microscope, these points prove to be villi injected with blood. Occasionally dull-white patches of greater or less extent, are observed, considerably lighter than the healthy membrane. The mucous coat is very often thickened, sometimes to a considerable extent, sometimes only in small spots. The increased developement is occasionally confined to the mucous follicles, which form numerous granules either disseminated through the membrane, or collected in clusters, and are sometimes so large as to give to the surface a mammillated appearance. Sometimes the membrane is found thinner than in health. It is almost always altered in consistence, being frequently indurated, but still more frequently softened. Ulceration is also not unusual, though less common than in inflammation of the ileum and colon. The mucous membrane exhibits either slight superficial erosions, or small isolated ulcers from inflammation of the follicles, or a larger and deeper ulcer, which sometimes penetrates into the other coats of the stomach, or even through them. In the latter case, the stomach is not unfrequently found adhering to the neighbouring viscera, the substance of which forms the bottom of the ulcer. These solitary ulcers are round or oval, an inch more or less in diameter, with abrupt edges often thickened and indurated in old cases, and appear as though they might have been formed by punching out a portion of the membrane. The ulcer is usually situated in the lesser curvature. Though generally solitary, there are in some rare instances, two or more. These ulcers are seldom or never found in persons under sixteen.* The points in which chronic gastritis differs from the acute, in relation to post-mortem appearances, are, chiefly, that in the former the colour is usually dark as above stated, induration frequent, and ulceration not uncommon; while in the latter, the colour is usually red, induration scarcely ever present, and ulceration rare.

It is important not to confound real pathological appearances with those which are merely cadaveric. It has been proved by Dr. Carswell that the colour of the blood, remaining in the vessels of the stomach, is often darkened by the gastric juice so as to resemble that of chronic inflammation. In this case, however, the blood has not usually been extravasated, and as it were incorporated with the membrane, as in gastritis. John Hunter long ago ascertained that softening and even destruction of the coats of the stomach might take place after death, from the action of the gastric juice. This was afterwards disputed; but the fact is now established beyond reasonable doubt. Cadaveric softening is usually found in the fundus, or in that part towards which the liquids in the stomach gravitate from the position of the body. It may be confined to the mucous membrane, or may extend to the whole of the coats. The excavations are usually in patches of various extent, with thin, soft, irregular, and sometimes fringed edges, unlike the swollen, often abrupt, and hardened borders of ulcers. Sometimes the softening is found in bands or stripes, when the stomach is wrinkled so as to bring the summit of the folds only into contact with the gastric juice. When these softened or excavated spots are stained of a brown or chocolate colour by the action of the juice upon the blood, the liability to form a wrong opinion is increased. One means of diagnosis is afforded by the fact, that the cadaveric softening is most apt to occur in the cases of individuals who were in good health, and had eaten a short time before death. Care must also be taken not to confound the softening of putrefaction with that of inflammation. It is, moreover, certain, that softening may result from other morbid processes besides the inflammatory.

Causes.—Chronic gastritis occasionally follows the acute; but, in the great majority of cases, it is an independent affection, resulting for the most part from long persisting, or frequently repeated irritation. The abuse of alcoholic liquors, habitual excess in eating, the employment of indigestible food as ordinary diet, and the excessive use of medicines, are among the most frequent causes. Congestion of the portal circulation, and the sympathetic irritation arising from disease in other organs, especially in the liver and spleen, may also give rise to the complaint. It is a frequent attendant upon phthisis, especially in the latter stages; and the tuberculous diathesis communicates to it an extraordinary obstinacy when it arises from other causes. But no disease probably is so productive of chronic gastritis as dyspepsia; and the two affections are so frequently associated, that by some authors they are considered identical. This subject will be discussed under dyspepsia. It is sufficient here to say that the chronic inflammation, which so often accompanies or follows that complaint, may be ascribed in great measure to the constant irritation of the undigested, or badly digested, or chemically altered food, and of the acrid and otherwise disordered secretions, which take the place of the healthy stomachic fluids, in consequence of the impaired energy of the organ.

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* See a good paper on ulcers of the stomach by Dr. Geo. Budd, in the *Lond. Med. Times and Gaz.*, June, 1853, p. 617, and July, p. 27.

Diagnosis.—The only complaints with which chronic gastritis is liable to be confounded, are cancerous and other organic affections of the stomach, gastralgia and analogous nervous affections, and dyspepsia. For the diagnostic characters, the reader is referred to the several diseases mentioned.

Treatment.—The first and most important indication, in the treatment of chronic gastritis, is the removal of the cause. As the disease in most instances either arises from irritating ingesta, or is sustained by them, and in all instances is aggravated by this cause, it is indispensably necessary to subject the patient to strict dietetic regulations. This, indeed, is often all that is necessary to effect a cure. But the same diet is not applicable to all conditions of the disease. It is necessary, in regulating it, to have reference to the stage and degree of the inflammation, and the state of the system. It must be borne in mind that the organ inflamed is that through which the system is nourished, and that, although it might be desirable in reference to the organ alone to restrict the diet most rigidly, yet the general debility may be such as to present still stronger claims to observance. Besides, the stomach itself may be injured by extreme abstinence, where the system is calling for support. Such are the sympathies of this viscus with the remainder of the body, that the suffering arising from deficient nutriment in every part is reflected upon it with especial force, and the stomach may thus be irritated in the midst of starvation. In this state of sympathetic suffering, its secretions are deranged, and themselves become an additional source of irritation. Hence, there is sometimes danger from that extreme abstinence upon which some authors have insisted; and patients have rapidly improved under a nutritious diet, after a long and fruitless abstemiousness. No precise rule can be laid down for all circumstances, except that in every case the food allowed should be of the kind most easily digested; as indigestible food, whether highly nutritious or otherwise, acts as a powerful irritant to the stomach. When the inflammation borders on the acute, and a slight febrile action exists, with a loss of appetite, farinaceous or mucilaginous liquids, such as solutions of tapioca, sago, arrow-root, and gum arabic, and decoction of barley, should be exclusively used. If the disease be quite chronic, and without fever on the one hand, or debility on the other, a more nutritious diet may be employed, consisting of stale bread, crackers, boiled rice, mush, and gruels; care being always taken that the solid substances should be thoroughly masticated. In cases of general debility, the diet may be improved by the addition of milk or fresh cream. In some instances, great advantage will accrue from restricting the patient to milk exclusively. This is especially useful in the cases attended with obstinate vomiting. The milk may, under such circumstances, be usefully mixed with one-third, or one-half, or an equal bulk of lime-water. I have found few means so effectual in relieving this exceedingly unpleasant form of chronic gastritis, as the exclusive use of such a diet. Patients who for weeks and months have scarcely been able to retain a meal, and who have been reduced to the lowest state of emaciation, have experienced an almost immediate change for the better under this treatment. As the symptoms improve, bread or crackers may be used with the milk and lime-water, and the latter ingredient may be gradually omitted. When the debility is considerable, a more nutritious animal diet sometimes becomes necessary. Oysters raw or roasted, soft boiled eggs, animal jellies, the white flesh of poultry and wild fowl, mutton, venison, &c., may be used; the caution being always observed to select only those meats which are easily digested. Boiled meats will also in general be preferable to those cooked in other modes. Of course, the diet will be varied in the same case according to the indications; and it will generally be proper, after persevering for a considerable time with a rigid antiphlogistic regimen, to allow a gradual improvement, as the patient is found to bear it. Attention should always be paid to the calls of the stomach; and, when the patient perseveringly demands certain articles of food, even though they may seem improper, the physician will often do well to allow their use, cautiously at first, and afterwards freely, should they be found, as they often will be, to agree well with the stomach.

Alcoholic drinks should in all cases be scrupulously avoided, except when the habitual and intemperate use of them may render a cautious withdrawal of them advisable. Coffee and tea should also be avoided; at least, only black tea should be allowed, and that weak. The patient may drink infusion of cocoa, or sweetened milk and water at breakfast and tea. On the whole, however, cold water is the best beverage. Whatever drink may be allowed, it should be taken in moderate quantities at a time, so as not to distend the stomach.

By the means above mentioned, without the aid of medicines, cures may often be effected; but it is necessary to persevere long, and to guard the patient against any premature relaxation of the dietetic plan. A single debauch, or indulgence for a short time in forbidden food, may undo the work of months. When there is reason to suspect the existence of the deep, solitary ulcer, it is of the utmost importance to adhere rigidly and for a long time to these rules of diet; and the food especially adapted to these cases is milk, with farinaceous substances finely comminuted, or in the liquid state. In some obstinate cases, attended with incessant vomiting, a system of entire abstinence from food by the stomach, the strength being supported by nutritious enemata of soups, with or without an opiate addition, has sometimes proved successful. I have known at least one case rescued from immediately impending death by this plan, conjoined with the use of nitrate of silver internally. The return to food must be very cautiously regulated.

Other remedies, however, will often prove useful as adjuvants. Should the local symptoms be severe and the pulse strong, blood may sometimes be taken from the arm with advantage; but general bleeding is very rarely required. Perhaps the most effectual measure, next to a proper regulation of the diet, is local bleeding from the epigastrium by leeches or cups. Leeches are generally preferred; as the pressure of the cups may prove hurtful to the stomach. It is usually better to take a small quantity of blood, and to repeat the operation occasionally, than to exhaust the patient by large numbers of leeches at once. Revulsion by means of small blisters on the epigastrium, frequently repeated, or of croton oil or tartar-emetic applied so as to pustulate, is often highly useful. Should the tartar-emetic, however, sicken the stomach, as it sometimes appears to do when externally applied, it should be omitted. Costiveness must be obviated by means of laxatives, or cathartic enemata, or both combined. The free use of medicines of any kind by the stomach is injurious; but enemata are of themselves scarcely sufficient to meet the indication to evacuate the upper as well as the lower bowels. The gentlest laxatives should be selected and sparingly used. Magnesia is one of the best, as it answers the purpose of an antacid, which is often wanted. Rhubarb, castor oil, and the Seidlitz powder may also be employed. The same end may often be advantageously accomplished by a laxative diet of bran bread, or rye mush, or of stewed fruits when these are found not to irritate the stomach. Attention should be paid to the skin. Frictions with the flesh-brush, the warm or hot bath, according to the degree of excitement, and flannel next the skin are all useful. Opium and ipecacuanha at bed-time sometimes answer a good purpose, by producing perspiration, as well as by enabling the patient to sleep. When there is great local suffering with general restlessness, small doses of the acetate or sulphate of morphia may be given occasionally with advantage; but care is always requisite to avoid establishing an injurious habit, which the patient may have difficulty in breaking. Hydrocyanic acid has been recommended under the same circumstances. The feet should be kept warm, if necessary, by rubefacient applications. Congestion of the portal circle, visceral disease, whether functional or organic, and, in the female, disorder of the menstrual function, should be relieved by appropriate remedies; regard being always had to the probability of injuring the stomach by irritating medicines.

When the measures above detailed do not answer, especially when there is reason to suspect the existence of ulcers, recourse may be had to the alterative remedies, which prove so useful as local applications in similar affections of the mouth and fauces. Sub-nitrate of bismuth, the sulphates of iron, zinc, and copper, and the nitrate and oxide of silver, have all been usefully employed. The nitrate of silver has within a few years attracted considerable attention, and has been given in larger doses than were formerly thought advisable. From one-quarter of a grain to a grain is often administered two or three times a day without disadvantage. Cures, in apparently desperate cases, are sometimes obtained by nitrate of silver thus employed. I have repeatedly seen patients rescued by this remedy, for whom all other hope had been abandoned. It has appeared to me to be peculiarly advantageous in those cases, frequently attended with vomiting, in which the tongue is smooth and glossy, as if deprived of the papillary structure. I cannot too strongly express my conviction of its great usefulness in chronic gastritis of this character. It is generally advisable to combine the metallic salts with small doses of opium, or one of the salts of morphia. Minute doses of mercurial pill, with or without ipecacuanha, according as the stomach will or will not tolerate the latter medicine, are also highly useful. A grain of the blue mass, with a sixth of a grain of ipecacuanha, may be repeated every two or three hours through the day, until the gums are very slightly touched.

Tonics in the advanced stages are sometimes useful, probably by giving to the tissue, relaxed by the previous inflammation, sufficient energy to take on a healthy action, and resume its ordinary functions. The chalybeates and simple bitters should be preferred. Oil of turpentine and copaiba have also been recommended.

In *gastrorrhœa*, which is often rather a condition consequent upon previous inflammation than itself inflammatory, the treatment by the mineral alteratives above mentioned, and by tonics, is peculiarly applicable. Should symptoms of inflammation exist, they should be combated in the ordinary manner. Should they be absent, the treatment may be commenced by an emetic of ipecacuanha followed by a calomel purge; and the bowels should afterwards be kept open by preparations of rhubarb or aloes, or a combination of the two. The vegetable bitters, chalybeates, and mineral acids may be used; but most confidence is generally placed in the sub-nitrate of bismuth and nitrate of silver, the latter remedy being given in the dose of half a grain or a grain twice a day. Opium or some one of its preparations may be combined with the mineral salts to relieve pain and check secretion. Copaiba and the turpentines, or their volatile oil, may be given with a view to their alterative action on the mucous membrane. These also may be usefully combined with opiates. The diet should in general be nutritious and digestible, consisting chiefly of farinaceous substances and animal food.

During the course of the treatment, in every form of chronic gastritis, efforts should be constantly made to prevent the mind from reacting injuriously on the stomach, and at the same time to remove excitement from this organ by diffusing it equably over the whole system. Hence the importance of regular though not violent exercise, of relaxation from the cares and anxieties of business, and of agreeable mental occupation. A complete change of scene often proves serviceable. Excursions to different parts of the country, visits to the springs and to the sea-shore, sea voyages, and a residence or travelling abroad, often prove effectual, when much movement is not contra-indicated, in bringing about a cure, or confirming convalescence.

Article II.

CANCER OF THE STOMACH.

Carcinoma attacks the stomach in all its different forms, whether of scirrhus, medullary cancer, or colloid cancer. The notion, at one time entertained by certain pathologists, that these tumours were simply the result of inflammation, has been entirely exploded. There is little doubt that mere effects of chronic inflammation, neglected or abused, have sometimes been mistaken for cancer; and there are also instances in which it would be difficult or impossible to determine, upon a mere inspection of the diseased parts, especially in scirrhous cases, to which of these complaints they should be referred. But the microscope has removed the difficulty, so far as post-mortem examination is concerned, and has satisfactorily shown, in many of the cases otherwise doubtful, that the disease is true scirrhus, by the detection of the proper cancer cells.

Symptoms and Diagnosis.—The symptoms of cancer in the stomach are so nearly those of chronic inflammation, that it is often impossible to distinguish the two complaints during life. It is unnecessary, therefore, to notice any other characters of the disease than those to which some value has been attached in reference to diagnosis.

The pain, which is almost always experienced, in a greater or less degree, and is sometimes excruciating, varies very much in its character. Lancinating pains have been thought to be diagnostic of cancer in the stomach, as of the same complaint elsewhere; but the fact has been well ascertained, that such pains occur occasionally in chronic gastritis, and are by no means present in all cases of cancer.

Vomiting is a very common, and very distressing symptom; but is sometimes wanting; and, in many instances, is unfrequent at the commencement. At first, the patient discharges his food or a glairy mucus; afterwards, together with these, sour, bitter, or acrid fluids; and, in the end, not unfrequently, blood, or a black matter which has been compared to soot and water, or to coffee-grounds. This black vomit, which has been looked on as characteristic, is, in fact, common to cancer and chronic gastritis. But, though not a certain sign, the character of the vomiting assists in forming a precise diagnosis, and sometimes points to the seat of the disease. Thus, when the food is rejected after it has been swallowed, and before it has entered the stomach, or when, after entering the stomach, it is retained, but quickly occasions excessive nausea and the discharge of a glairy mucus, there is reason to suppose that the cardiac orifice may be affected. If the stomach reject almost everything which it receives, after having retained it for some time, the probability is that the pylorus is occupied by a cancerous tumour, and resists the passage of the chyme. When, after frequent vomiting, the patient ceases to be troubled in this way, but is seized with a severe and exhausting diarrhœa, it may be inferred that the mucous membrane at the pylorus has been destroyed by ulceration, and thus opened a wider passage. Generally speaking, when the mucous coat has become disorganized, there is less vomiting, as the sensibilities through which this action is excited reside chiefly in that membrane. The bowels are usually obstinately constipated, though diarrhœa sometimes occurs towards the close.

The cachectic countenance of cancerous patients is one of the most characteristic symptoms. The complexion has a peculiar yellowish-white, waxen appearance, which is not often met with in other complaints.

But the most certain diagnostic symptom is a tumour in the epigastrium. This is discovered at various periods in the progress of the complaint, and of course is obvious in proportion to the emaciation. It is most readily perceivable when in the pylorus, or great curvature of the stomach. Sometimes, however, the absorbent glands in the vicinity of the stomach are much swollen, and other tumours in the same neighbourhood may be mistaken for scirrhus. But, when the tumour is associated with the other symptoms above mentioned, there can be little doubt of its carcinomatous character.

The progress of cancer of the stomach, and its duration, are very variable. Sometimes the complaint runs its course in a few months, sometimes continues for many years. Occasionally it appears to be latent for a long time, and then to start at once into vigorous action; and instances are not wanting, in which the symptoms have so much remitted as to give hope of cure, but have again returned with increased severity. Death usually occurs from the exhaustion of combined irritation and deficient nutrition, and is preceded in general by great emaciation, and a long and wearisome period of diversified suffering. It is sometimes hastened by ulcerative openings into the cavity of the abdomen, producing peritoneal inflammation. The tortures of hunger are added to the other sufferings, when the disease affects the cardia.

Anatomical Characters.—The stomach is sometimes much contracted, with thickened coats, and sometimes greatly enlarged. The latter is apt to be the case when the pylorus is diseased. The interior surface is usually covered with a brown mucus. The cancerous disease may occupy the whole stomach, or any part of it; but is most frequent at the two orifices, and especially at the pyloric. It is sometimes limited by these orifices, and sometimes extends beyond them into the œsophagus or duodenum. The appearances vary with the period at which the patient dies, and with the character of the cancerous affection. In scirrhus, if ulceration has not taken place, the inner coats of the stomach are found in general more or less confounded together, into a whitish, indurated, semi-cartilaginous mass, from two or three lines to several inches in thickness. The peritoneal coat is much less liable to be affected than the others, and often remains free from disease. The muscular, mucous, and intervening cellular coats may often be recognized in a state of greater or less alteration. Sometimes the disease is confined chiefly to the submucous cellular tissue, and sometimes to the mucous membrane itself.

Instead of this thickening of the coats, the disease occasionally consists of a roundish mass or masses, projecting from the submucous tissue, or the mucous membrane, into the stomach. Instead of being indurated and white, the tumour is sometimes of a soft or brain-like consistence, constituting medullary cancer, and sometimes red, as if injected with blood, resembling fungus hæmatodes. In another form of the disease, the parietes of the stomach are thickened, and, instead of their usual structure, present numerous cells separated by fibrous partitions, and filled with a gelatinous deposit. This is colloid cancer.

In a more advanced state of the disease, ulcers are found with hard, elevated, and reverted edges, and a surface irregular with fungoid excrescences, and often exhibiting the open orifices of blood-vessels of considerable magnitude. They are found in different stages of their progress, showing a disposition to extend both in breadth and depth, and not unfrequently perforating the coats of the stomach. In this case, the peritoneal coat has often contracted adhesions with the liver, spleen, pancreas, or other neighbouring organ, the substance of which is thus penetrated by the disease, and forms the basis of the cancerous ulcer. Sometimes the adhesion is formed with the colon or diaphragm, and the contents of the stomach thus escape into the bowels or lungs. Again, the ulcer is seen opening directly into the cavity of the abdomen, which exhibits the marks of severe peritoneal inflammation. Cases are on record in which the carcinomatous affection has extended anteriorly to the abdominal parietes, or posteriorly to the spine, before the fatal issue.

Causes.—Cancer in the stomach arises probably from the same causes as those which produce cancer elsewhere. What these causes are is uncertain. We must be content with ascribing the result to a peculiar predisposition or diathesis; but of the origin of this we know nothing. It is highly probable that whatever irritates or inflames the stomach may call the predisposition into action. It is certain that the disease is at least aggravated by such influences. The abuse of alcoholic liquors, excesses in eating, and the employment of tonic and stimulant medicines, which are often administered in the early stage of cancer of the stomach, under the impression that it is dyspepsia, hasten the progress of the complaint, and perhaps call it prematurely into existence. The depressing emotions are thought to favour its production; and Napoleon, on the Island of St. Helena, may be cited as an example.

The disease is exceedingly rare before puberty, and seldom occurs until after the twenty-fifth year. It is most common in middle life; but is not unfrequent in the old. Males are said to be more subject to it than females.

Treatment.—This must be entirely palliative. All that can be expected is to protract life, and alleviate suffering. For this purpose, nothing is so important as to regulate the diet properly. As a general rule, no stronger drink should be allowed than water, and spices and other condiments should be avoided. The food should be mild, easily digestible, and nutritious, so as not to stimulate the stomach either by its quality or quantity. It may consist of the farinaceous substances, milk, cream, boiled meats, broths, oysters, &c. Nothing, on the whole, is so suitable as milk. Large quantities either of food or drink should not be taken at once. The bowels should be kept open by enemata, or by the mildest laxatives. Attention should be paid to the skin as in chronic gastritis. Acidity may be corrected by the bicarbonate of soda or of potassa, or by lime-water with milk as food. A few leeches occasionally applied to the epigastrium, and revulsion towards the same place by means of rubefacients or epispastics, will sometimes prove useful by dimi-

Very frequently this alterative treatment will be sufficient, without the antecedent use of a brisk cathartic.

Irritation from the Gastric Contents.—The cases are very numerous, in which the excitement of stomach produced by irritating substances contained in it, though so slight or brief as not to be entitled to the name of inflammation, is yet sufficiently beyond the line of health to call for the notice of the physician. The symptoms, in such cases, are exceedingly diversified. The patient generally experiences more or less epigastric uneasiness, which is of a variable character, sometimes not exceeding a morbid feeling of heat, or a slight gnawing sensation, sometimes amounting to burning pain, or cardialgia, and occasionally gastralgic or spasmodic. Some of the most violent cases of spasm of the stomach that I have witnessed, have arisen from the presence of indigestible food. This uneasiness is frequently associated with nausea, and occasional but ineffectual efforts to vomit, or with eructations of fetid, sour, acrid, or bitter fluid, according to the nature of the cause. The pulse is generally slow, sometimes more feeble than in health, the skin often cool, and the tongue either unaltered, or slightly furred towards the root, or covered with a clammy mucus. Among the sympathetic affections are often supra-orbital headache, pains in the loins and extremities, general malaise, chilliness, urticaria or other cutaneous eruption, and sometimes stupor or coma. In children and delicate females, the nervous disorder amounts sometimes to convulsions. When the sympathetic affection is considerable, the gastric symptoms are usually masked, and wrong inferences may be drawn. Under these circumstances, the existence of nausea, or some tenderness on pressure in the epigastrium, will often indicate the real seat of the disease. After a variable period, either full vomiting takes place, or the contents of the stomach pass downward through the pylorus; and, in both cases, prompt relief is obtained. Occasionally, however, when the irritation has been considerable and protracted, the depression following the excitement is so great as to incapacitate the stomach, for one or two days or more, for the proper performance of its functions. Should the cause continue to act, inflammation becomes established.

Excess in drinking or eating; indigestible food; substances which from idiosyncrasy disagree with the patient; acrid medicines and poisons; the products of acid fermentation, or other chemical change in the food after it has been swallowed; excess of acid in the gastric liquors, and other acrid secretions of the stomach; bile which has ascended from the duodenum; worms in the stomach; such are the most frequent agents in the production of this variety of gastric irritation. There is some little difference in the operation of these causes. Thus, indigestible food is most apt to produce spasm of the stomach, acid or other acrid matters to occasion cardialgia, and excess of bile probably to provoke vomiting. The results may take place in a stomach otherwise healthy, if the cause be sufficiently intense; but, when the irritation proceeds from substances used as food, it is most easily induced by eating heartily when the stomach is temporarily debilitated, as after violent exercise, by which nervous energy has been diverted from the viscera to the muscles. The character of the offending agent may often be known by the taste or colour of the matter discharged by eructation. Worms are often indicated by a sense of choking, and frequent ineffectual efforts to vomit, as if there were some foreign body in the œsophagus.

Treatment.—This is very simple. In mild cases, abstinence or the use of a very restricted diet for a day or two will be sufficient. In severer cases, the most effectual remedy is an emetic. When the patient is disposed to vomit, large draughts of warm water, or of warm chamomile tea, will often be suffinishing inflammation. To relieve the pain or local distress, to quiet irritation, and promote sleep, it is necessary to resort to anodynes; and the preparations of opium are the most effectual. The salts of morphia, or the black drop, are probably the best of these for the purpose. The extracts of hemlock and henbane, and lactucarium may be used as adjuvants of opium, or as substitutes. Sometimes it is best to administer opium or laudanum by enema, or to sprinkle acetate of morphia, in powder, upon a raw blistered surface in the epigastrium.

Article III.

IRRITATION OF STOMACH.

By this term is meant any morbid excitement of the stomach, not amounting to inflammation. Instances of disorder of this kind are exceedingly common, although not usually associated by writers under this name, and often too much neglected in practical treatises. Though seldom in itself dangerous, irritation of stomach is in many of its forms very distressing to the patient, and, if not arrested, often terminates in gastritis, either chronic or acute. It presents itself in a variety of forms, dependent on the tissue or function affected, the nature of the cause, and the previous condition of the stomach or the system. It sometimes affects the organic functions especially, sometimes the nervous exclusively, and both at the same time. Though often merely the antecedent of inflammation of the stomach, or frequently a secondary or attendant affection of other diseases, it yet has in numerous instances an independent existence, and therefore requires an independent consideration. I shall treat of its different forms first in relation to the causes, and secondly in relation to the phenomena. This will necessarily lead to some repetition, but is necessary to a satisfactory view of the subject.

1. *In Relation to its Causes.*

Irritation from Congestion of the Portal Veins.—From a sluggish state of the portal capillaries of the liver, or from other causes, the blood frequently accumulates in the veins which supply the vena portarum, and consequently in the capillaries of the stomach, which is excited into morbid action by the unusual amount of stimulus. The affection is attended with a sense of fulness, weight, or uneasiness in the epigastrium, sometimes amounting to pain. The appetite is somewhat impaired, the tongue often slightly furred near the root, the stools scanty, or light coloured from deficiency of bile, the complexion sometimes sallow, and the mind irritable or depressed, and disposed to view everything in a gloomy light. The condition is one of those to which the name of bilious complaint is often vaguely applied. It is a frequent antecedent to bilious fevers, cholera morbus, jaundice, and vomiting of blood; and there is reason to believe that some of these diseases might often be prevented by its timely treatment. It occurs most commonly at the commencement, or during the prevalence of hot weather, but is found at all seasons. A full dose of the compound cathartic pill, or other active purgative combination containing calomel or the mercurial pill, with a farinaceous diet for a day or two, will frequently remove the complaint. Should the hepatic secretion not be sufficiently restored in this way, a mercurial pill, or a grain of calomel may be given at night, and followed by a mild laxative in the morning; and this plan should be continued every day, or every other day, until the passages indicate that the liver is acting freely.

vomiting, which is incessant and excessive, so that the patient can retain scarcely anything upon the stomach. The tongue is generally clean, or but slightly furred, and the appetite very variable, being in some cases wholly wanting, and in others unimpaired. Occasionally slight febrile symptoms appear. The duration is altogether uncertain, sometimes for a few hours only, sometimes for days, weeks, and even months or years. It is obvious that those cases must be the most obstinate, which depend on organic disease of the spine. Such cases are easily recognized. So also are those in which the spine is painful on being pressed, in the region opposite to the stomach. The most obscure cases are those in which the ganglia or nervous plexuses are the source of the mischief. These must always be more or less conjectural. It is important, in doubtful gastric affections, to make pressure on the spinous processes of the vertebræ; as very often a seat will thus be discovered for the effectual application of remedies.

Treatment.—This must be directed especially to the spine. It will be vain, as a general rule, to address remedies to the stomach. Temporary relief may be obtained from anodynes, especially, according to M. Barbier, from the preparations of codeia, when the solar plexus is the source of irritation; but the symptoms return with undiminished force upon the suspension of the medicine. The most effectual remedy is leeching or cupping upon the spine, at the point where tenderness is discovered upon pressure. Almost instant relief is sometimes obtained in this way. It is often, however, necessary to repeat the local bleeding, and, in some cases, several times before a cure is accomplished. When the complaint does not yield to this remedy, blisters may be applied over the spine at the spot affected; and, in cases of a chronic character, pustulation by croton oil or tartar emetic, sustained for a considerable time, will be found very useful. In very obstinate cases, setons, issues, or moxa may become advisable. The diet should consist chiefly of farinaceous substances, as stale bread, crackers, boiled rice, gruels, &c., in acute cases; but, when the appetite is unimpaired, the light and most digestible kinds of animal food may be employed. The bowels must be kept regularly open by mild aperients or enemata.

Irritation from Sympathy.—Such is the connexion between the stomach and other parts of the system, that it suffers more or less with almost every severe disease wherever seated. Thus, it is one of the first organs to participate in that general movement denominated fever, no matter what may be its origin. A violent injury in any part of the body is not unfrequently attended with nausea and vomiting. But the organs with which the stomach appears to have the closest connexion, are the brain, the abdominal viscera, and the parts concerned in the reproductive function, especially the uterus. Of the phenomena, however, which arise through sympathy with these organs, as well as of the requisite mode of treatment, it is unnecessary to speak here; as they will be fully considered under other heads.

2. *In Relation to the Phenomena.*

It is necessary to consider gastric irritation also in the varieties afforded by its varying phenomena. These frequently occur separately, or in distinct groups, having the aspect of distinct diseases, and as such are sometimes treated of by authors. It is true that they are often variously mingled together, and that they not unfrequently occur merely as symptoms of other diseases; but, as they also frequently appear more or less isolated, and are the most striking object to the eye of the practitioner, it is advisable to give them a separate consideration.

Cardialgia.—This term is often confounded with *gastrodynia* and *gas-*

tralgia, and, from its origin (καρδια and αλγος), would appear to signify nothing more than pain about the cardiac orifice. But it is also frequently used as synonymous with *heartburn;* and it will be found convenient to restrict its application to that painful feeling of heat or burning, which so often attends inflammation or irritation of the gastric mucous membrane. This sensation may, indeed, be considered as characteristic of inflammation or vascular irritation of the stomach, in contradistinction to mere nervous irritation. It is a very common attendant upon the presence of acrid matters in the stomach, and has been looked upon almost as diagnostic of acidity. It is to be relieved, of course, by the remedies calculated to cure the pathological condition of which it is a symptom.

Gastralgia.—*Gastrodynia.*—These terms, as their origin indicates, simply imply pain in the stomach. I employ them to express pure or simple pain, without those complications of morbid sensation which so often occur in stomachic affections. This is not unfrequently present in gastritis, whether acute or chronic; but it is also very often purely nervous, without any appreciable vascular disease; in other words, is a true neuralgia of the stomach. In this light I now propose to consider it.

Causes.—Gastralgia may proceed from disease of the spinal marrow or sympathetic nerve, from gout or rheumatism affecting the stomach, or from certain not very accurately defined conditions of the system, which constitute a predisposition to neuralgia in general. It not unfrequently occurs in the convalescence from acute diseases, and in debility from other causes, such as meagre diet, impaired digestion, profuse evacuations, and especially the loss of blood. Anemic and hysterical females are very subject to it. Anxiety of mind, and the habitual influence of strong and contending emotions, frequently act as predisposing causes. When the predisposition exists, the slightest cause is sufficient to bring on the pain. Any disturbing emotion, any local affection which may react sympathetically on the stomach, even the mildest articles of food or of drink, are capable of inducing a paroxysm.

Diagnosis.—The only affection with which pure gastralgia is liable to be confounded is inflammation of the stomach. It wants the febrile symptoms, the great prostration, the nausea and vomiting, and the steady course which mark acute gastritis, for which, therefore, it can scarcely be mistaken. From the chronic form of the disease it is not always so easily distinguished; the symptoms in the latter being so variable, that it is impossible to institute a precise comparison applicable to all cases. No one symptom in the following catalogue can be considered as uniformly diagnostic; but the whole, taken together, will lead almost always to a correct conclusion.

The pain in gastralgia is usually severe, uncomplicated, and often capricious, occurring irregularly, and sometimes leaving the patient altogether for a time. Instead of being increased, it is often relieved by pressure, though this is not invariably the case. In chronic gastritis, it is usually dull, often complicated with burning or other disordered sensation, more steady, seldom being entirely wanting, and almost always aggravated by pressure in the epigastrium. In the former affection, the appetite, though variable, is often undiminished, vomiting and excessive thirst unusual, and digestion frequently as vigorous as in health; in the latter, the appetite usually suffers, nausea and vomiting are not uncommon, the patient is apt to be annoyed with thirst, and digestion is almost always impaired. The tongue in gastralgia is not unfrequently healthy, the skin cool, and the pulse quite undisturbed; while, in chronic gastritis, though the same condition of these parts may sometimes exist, the contrary is more frequently the case. The neuralgic affection may be attended with various sympathetic nervous disturbances, such as dyspnœa, palpitation, restlessness, morbid vigilance, &c.; but wants the extreme emaciation and hectic symptoms which mark the advanced stage of the inflammation. The spirits in both are usually depressed, but in gastralgia are more variable, being excessively low during the paroxysms, and again bright and cheerful when the pain remits or retires. Hot and stimulating drinks generally aggravate chronic gastritis, while they often relieve gastralgia. In both, constipation is an almost constant attendant, unless the case is complicated with chronic enteritis, which is much more likely to happen in the inflammatory than in the nervous affection. Not unfrequently the two affections are combined in the same case, and the diagnosis is thus obscured. In doubtful cases, it is safest to treat the disease as chronic inflammation, and, if the measures employed fail, then to address our remedies to the neuralgic condition.

Treatment.—The most urgent indication, in severe cases, is for immediate relief from pain. For this purpose, anodynes must be used internally, and a strong impression made upon the epigastrium by rubefacient or epispastic applications. Opium, or some one of its preparations, is the most efficient anodyne; but other narcotics, as hyoscyamus, stramonium, belladonna, extract of hemp, lactucarium, and chloroform, separate or combined, may often be advantageously resorted to, especially when it is necessary to sustain a constant impression for a considerable time. Hydrocyanic acid has also been highly recommended; and it is probable that the smoking of tobacco might sometimes prove beneficial. Great relief is asserted to have followed the use of powdered charcoal; but the pain, in these instances, has probably proceeded from irritant matters in the stomach. According to Dr. Belloc, the best form of charcoal is that prepared from the wood of the poplar. It may be taken in the form of an electuary, in the dose of a teaspoonful several times a day. Where a sudden, but fugitive external impression is desired, a sinapism should be applied over the stomach; when the impression is to be more permanent, a blister of Spanish flies. Both indications may be met by the use of strong solution of ammonia. Advantage will sometimes be found in sprinkling the acetate or sulphate of morphia over the blistered surface, deprived of the cuticle.

A second indication is to change that condition, whether of the stomach or of the system, upon which the predisposition to the disease depends. When the gastralgia is associated with debility, as in convalescence from febrile diseases, this object may often be effected by the use of tonics. I have seen the affection speedily give way to the pure vegetable bitters, or to quinia. The former may be given in infusion with aromatics, and a little senna or rhubarb. The latter is an almost certain remedy when the disease is regularly intermittent. In anemic cases the chalybeates are preferable. The alterative mineral tonics have enjoyed great reputation in the disease. Nitrate of silver was recommended by Dr. James Johnson; but subnitrate of bismuth has been more employed. The latter preparation should be given in the dose of from three to five grains three times a day. All these remedies may be advantageously combined with opium or the narcotic extracts. It should always be ascertained whether the disease is connected with spinal irritation, and if so, the remedies should be applied accordingly. (See *page* 555.) If it be of rheumatic or gouty origin, in addition to other measures, stimulant applications should be made to the extremities. To meet this same indication, all those means should be employed which are requisite for confirming the general health, such as exercise in the open air, sleeping in well-ventilated apartments, and in summer upon mattrasses instead of feather-beds, relaxation from the anxieties and fatigues of business, and cheerful society and agreeable recreation when attainable. Great advantage will often accrue from visits to the watering-places, a sea-voyage, or a protracted journey or residence abroad. Sea-bathing, or the occasional use of the shower-bath, may be added to the other measures.

In order to avoid sources of irritation, the diet should be carefully regulated. The rules which will be given hereafter, under the head of dyspepsia, are applicable in the present case. Advantage is sometimes experienced from stimulating drinks, as a little brandy and water during meals; but the moral hazard is, on the whole, greater than any probable benefit.

Pyrosis.—*Waterbrash.*—The term pyrosis has been differently employed, sometimes to signify merely a burning pain in the epigastric region, sometimes as the title of a peculiar affection usually called waterbrash. I follow the example of Cullen, whose authority has almost fixed the meaning of the words among English and American physicians, in using the term cardialgia for the former purpose, and pyrosis exclusively for the latter; although it must be confessed that this application of the words is not supported by their derivation. Cullen's description of the disorder now under consideration has scarcely been improved by subsequent writers.

Pyrosis usually occurs in paroxysms. It commences with a sense of constriction and pain at the pit of the stomach, which is increased by an attempt to assume the erect posture, and thus causes the patient to lean forward. The pain is often very severe, and is sometimes attended with a burning sensation. After a while, the patient discharges by eructation considerable quantities of a thin watery fluid, which is generally quite tasteless, though sometimes, probably from accidental causes, sour or acrid. Under this discharge, the pain gradually lessens, and ultimately ceases altogether. The fluid is not usually thrown off at once, but by repeated eructations, which continue for a considerable time. The attacks most commonly occur in the morning or forenoon, when the stomach is empty, but often also at other periods. When they have once occurred, they are apt to be repeated at varying intervals for a great length of time. In the intervals, the patient is often exempt from dyspeptic or other morbid gastric symptoms, thus proving that the affection is not essentially dependent upon dyspepsia, or chronic inflammation of the stomach, although it may be associated with those diseases.

Causes.—The causes of pyrosis are not well understood. It occurs most frequently among those who are meagerly fed, and at the same time indulge in spirituous liquors. Hence, it is said to be common in Scotland and Ireland, where the lower classes live chiefly on oatmeal and potatoes, and have been in the habit of using whiskey freely. Linnæus mentions that it is prevalent in Lapland; and, according to Dr. Magnus Huss, of Stockholm, it is very common throughout Sweden, so as to be a real national scourge, from which few of the lower classes escape. The author ascribes it to the abuse of spirits, and the habitual use of indigestible food. (*Archives Gén.*, 5e sér., i. 519.) But it is confined to no class, nor to any particular mode of life. It seldom, however, occurs before the age of puberty, or in old people, and is more common in women than men. According to Cullen, its attacks may be brought on by cold applied to the lower extremities, or by any considerable emotion of the mind, but for the most part occur without any known exciting cause. Any cause calculated to disturb the stomach, independently of diet, may occasionally induce an attack, as pregnancy, mental anxiety, &c.

Nature.—As to the nature of the affection, we may infer from the symptoms that it is a combination of gastralgia with vascular irritation of the mucous membrane, occurring paroxysmally, and relieved at each attack by a copious elimination of fluid from the exhalant vessels of the stomach. The pain does not appear to be produced by the presence of the fluid, which is usually quite bland; but to be relieved by the production of the fluid. In this respect it differs entirely from cardialgia, in which the uneasiness is excited by the irritating character of the contents of the stomach. The two affections, however, may co-exist, especially in dyspeptic cases; and in such we may have the burning pain, and acrid or sour discharges, along with the paroxysms of pyrosis. The complaint is confounded by some writers with gastrorrhœa, or catarrh of the stomach. But, in the latter, the discharge is mucous, and proceeds probably from the mucous follicles, either inflamed, or in that relaxed condition which sometimes follows inflammation.

Treatment.—The pain may be relieved by opiates or other narcotics, as in gastralgia, conjoined if necessary with revulsive applications to the epigastrium. If the liquid discharges be sour, magnesia, bicarbonate of soda or potassa, or aromatic spirit of ammonia may be united with the anodyne. But this treatment is only palliative. The curative processes must be applied in the intervals. If chronic gastritis exist, the measures should first be directed to the cure of that affection. If there be no inflammation, the patient should be put upon the course of treatment, as respects medicine, regimen, and modes of life, applicable to dyspepsia. Some particular remedies, however, have been recommended as especially useful in this affection. Among these the most prominent is subnitrate of bismuth, given as directed under gastralgia. Nitrate of silver may also be employed with prospect of advantage. Oxide and sulphate of zinc, and the vegetable astringents, have been recommended. Linnæus speaks favourably of nux vomica. This may be given in the dose of five grains three times a-day, or its active principle strychnia, in the dose of from the twelfth to the sixth of a grain. Much may be expected from sulphate of quinia freely administered, in cases entirely free from symptoms of inflammation. Dr. Caldwell states that he has known cures effected by the use of lime-water and milk, with blisters to the epigastrium. (*Notes to Cullen's First Lines.*)

Spasm of the Stomach.—*Cramp of the Stomach.*—By these terms is meant any painful morbid contraction of the muscular coat of the stomach. The ordinary peristaltic movement may become painful, in consequence of an inflamed or highly sensitive state of the muscular fibre, or of the parts moved by its contractions. In such cases, the affection is not spasmodic. Spasm of the involuntary muscles bears the same relation to their ordinary healthy contraction, that a similar affection of the voluntary muscles does to their voluntary movements. These are often painful without being spasmodic, as for example in rheumatism. To constitute spasm of the stomach, therefore, it is necessary that the contraction should not only be painful, but unusual, either in degree or direction. This disorder is very analogous to gastralgia; but, in the latter, there is not necessarily any unusual movement of the stomach. The two conditions, however, often co-exist.

Spasm of the stomach is characterized by a sense of pain and stricture or contraction in the epigastrium, occurring in paroxysms, with a remission or complete intermission of pain in the intervals. The stomach sometimes feels as if drawn towards the back, sometimes as if gathered into a ball. The pain varies somewhat in position, being diffused over the epigastrium, or confined to a portion of it, according as the whole or a part of the stomach is affected. Sometimes it extends up into the breast, when the œsophagus participates in the spasm. During the paroxysm, the patient usually holds himself in a bent position. Nevertheless, the pain so far from being increased, is ordinarily somewhat relieved by pressure from without, although, after the subsidence of the spasm, the stomach is left sore and tender to external impression. This is an important fact in reference to diagnosis. All violent spasmodic action is apt to be followed by a feeling of soreness or tenderness, as if the part had been severely pinched. Tenderness in the epigastrium, therefore, remaining after a paroxysm of gastric spasm, must not be considered as an evidence of inflammation. The pain is in various degrees, from a slight fugitive affection, which scarcely merits notice, up to the most violent of which the human frame is susceptible. Perhaps no physical agony is greater than that of the severest spasm of the stomach. Strong and determined men sometimes scream under its violence. In moderate cases, little sympathetic disturbance of any kind is experienced; the pulse and skin both remaining nearly in their ordinary state. But, when the spasm is violent, a shock is extended through the nervous centres to the whole system, somewhat analogous to that which results from a sudden and severe injury. The skin becomes cool and clammy, a cold sweat stands upon the brow, and the pulse is reduced in strength so as sometimes to become fluttering, or scarcely perceptible. Indeed the shock is occasionally fatal; the vital actions ceasing entirely, under the tremendous concentration of nervous energy in the stomach. Thus, death sometimes occurs from the effects of indigestible food, or of gout translated from some other organ to the stomach. Nausea and vomiting are not usual concomitants of spasm of the stomach, unless when the latter depends upon some offending matter in the viscus. In such cases, the nausea is experienced between the paroxysms, being replaced during their continuance by the more violent sensation. In the act of vomiting, the stomach often contracts spasmodically, and occasions excruciating pain.

Causes.—Whatever irritates the mucous coat may throw the muscular sympathetically into spasm, especially when there is a strong predisposition to that affection. Hence, it is frequently caused by indigestible food, such as boiled cabbage, cucumbers, lobsters, &c.; by substances which disagree with the stomach in consequence of idiosyncrasy; and by irritating matters in the stomach, whether the result of alteration in the food or of secretion, as acid in excess, acrid gastric juice, and bile regurgitating from the duodenum. In all these cases, the occurrence of nausea in the intervals between the spasms, and occasional eructations or abortive efforts to vomit, will sometimes serve to indicate the nature of the cause. Another common cause is a collection of air, either resulting from the fermenting food, or from a secretory act of the stomach. This will often be indicated by belching. Spasm of the stomach may be occasioned also by congestion of the portal system of veins, by irritation of the spinal marrow or sympathetic nerve, by gout or rheumatism, by cold externally applied, especially to the extremities, and by very cold water taken into the stomach, when the body is overheated or perspiring. In many persons, a strong predisposition to the affection exists. We find it especially in those debilitated by improper indulgences, irregular modes of life, the long continuance of depressing emotions, or certain chronic disorders affecting particularly the nervous system. Hysterical females, and gouty and dyspeptic individuals are peculiarly subject to it. When the predisposition exists strongly, very slight causes are sufficient to bring it into action. The least irregularity of diet, or any unusual emotion, especially of an agitating character, even mental association without emotion, may serve as an exciting cause. I have heard of a woman, in whom the smell of an apple was sufficient to induce an attack of spasm in the stomach.

Treatment.—This must vary with the cause, and the precise measures necessary will be indicated in connexion with the complaints of which this affection is an accompaniment. It will be sufficient here to point out the remedies in a general way. If the spasm proceed from offending matters in the stomach, especially from undigested food, these should be evacuated by an emetic of ipecacuanha, which should be followed by a mild cathartic. When the affection is not severe, it will be sufficient, instead of the emetic, to administer a dose of castor oil with laudanum. If the offending matter be acid, magnesia or other antacid should be given; and the aromatic spirit of ammonia will be found peculiarly useful from its stimulant properties. After vomiting, if that should be deemed necessary, and if not, immediately, recourse must be had to anodynes. In severe cases, two or three grains of opium, or an equivalent dose of laudanum, black-drop, or one of the salts of morphia, should be given at once, and repeated every half hour or hour till relief is obtained. The opiate may in general be given in connexion with the cathartic or antacid, when either of these may be considered necessary. In the absence of all inflammation, or high vascular excitement of the stomach, certain stimulants, especially the nervous, such as Hoffmann's anodyne, ether, musk, and the preparations of ammonia, may be usefully conjoined with the anodyne. If the spasm be caused or accompanied by flatus, the aromatics may be freely used, as the essence of peppermint, spearmint, or pennyroyal, ginger tea, the compound spirit of lavender, compound tincture of cardamom, oil of turpentine, &c. External applications, such as have been mentioned under gastralgia, should never be neglected. The most efficient, on the whole, is a sinapism of pure mustard. Obstinate spasm of the stomach has yielded immediately to the revulsion produced by a large cupping-glass applied to the epigastrium. When there is evidence of considerable vascular excitement of the stomach, or the disease is inflammatory, it is advisable to take blood from the arm, and in some cases to bleed largely. Cups or leeches to the epigastrium may be superadded, or substituted, according to circumstances. When portal congestion or hepatic disease exists, the anodyne remedies should be united with, or followed by, a dose of calomel. Should the spine be in fault, the remedies should be applied to that part. (See *page* 555.) In gouty and rheumatic cases, the irritation should be invited to the extremities by rubefacient applications. To relieve the predisposition to spasm, the treatment must be directed according to the condition of the system, and the particular state of the stomach. The measures recommended in gastralgia will be found useful here.

Nausea and Vomiting.—The stomach throws up its contents in two different modes; *first*, by *regurgitation* or *eructation*, which is effected by the contraction of the stomach, assisted sometimes by the voluntary contraction of the diaphragm and abdominal muscles; and *secondly*, by *vomiting*, which is the result of various combined involuntary movements, made through the instrumentality of the brain. The former is not essentially a morbid action, as it often occurs in health. It is to the latter that the following observations refer.

Phenomena.—Vomiting is very generally, though not always, preceded by the peculiar condition denominated nausea, or sickness of stomach. This is a distressing sensation always referred to the stomach, unattended with pain, and of so peculiar a character as not to admit of description. It is accompanied, in various degrees, with a feeling of general languor and debility, a small, feeble, often irregular pulse, a pale, cool, and moist skin, general muscular relaxation, rigors and trembling, sunken features, and an increased flow of saliva, and probably also of bile. At different periods after the commencement of the nausea, varying from a few seconds to several hours, the diaphragm and abdominal muscles contract suddenly and convulsively upon the stomach, the muscular coat of which also contracts; while the œsophagus, which is ordinarily in a state of constriction at the cardiac orifice, relaxes so as to allow the passage of the gastric contents upwards. All these movements are simultaneous. In some instances the œsophagus appears to relax only partially, or not at all; and then those ineffectual efforts to vomit take place, which are denominated retching. Occasionally the nausea continues long, and is very distressing, without the occurrence of either vomiting or retching; and, in rare instances, vomiting appears to come on suddenly and unexpectedly, without any preceding nausea, or at least with so little as not to attract notice. During the act of vomiting, the return of the blood from the head is impeded, and there is consequently flushing of the face, with swelling of the external parts of the head, and a feeling of fulness and distension in the temples, which is sometimes painful. Apoplexy has resulted from the pressure made on the brain in the act of vomiting. The pulse becomes slower and fuller, probably in consequence of this pressure. The stomach sometimes contracts so violently as to produce a painful feeling of spasm, though it would appear, from the experiments of Magendie, that its contraction is not absolutely necessary to the act of vomiting. When the vomiting subsides, the patient is generally left in a state of universal relaxation, with a soft pulse, a moist skin, and a disposition to sleep.

Explanation.—In the production of the above phenomena, the first impression is probably, in most cases, upon the stomach, whence it is transmitted to the brain, giving rise to the sensation of nausea, which is referred to the epigastric region. After the impression upon the brain has reached a certain degree of intensity, an influence is sent down to the various parts concerned in vomiting, by which these parts are brought into simultaneous action. It is thus seen that the intervention of the brain is essential to the result. But it is not necessary that the original impression should be made upon the stomach. Other organs are susceptible of modifications in their condition, capable of inducing the same state of the brain, and consequently the same results of nausea and vomiting, as when the stomach is the incipient point of the movement. It may be said that, in these cases, the morbid impression is sent first sympathetically to the stomach from the organ primarily affected, and thence transmitted to the brain. This may be true in those instances in which the organ is connected with the stomach by means of the sympathetic nerve. But, in other instances, the stomach is probably brought into the circle of morbid movement solely through the brain. That this is possible is proved by an experiment of Magendie, who removed entirely the stomach of a dog, and, having substituted for it an inert bag filled with liquid, succeeded in bringing on vomiting by injecting tartar emetic into the veins. Again, the original movement is often in the brain itself. Nothing is more common than nausea and vomiting dependent upon derangements of that organ. Mental associations alone are sufficient to produce the result; as must be evident to those in whom the sight or smell of an object, which has already produced sickness of stomach, occasions a return of the affection. It appears, therefore, that nothing more is requisite to occasion nausea and vomiting than the production, in any mode whatever, of that state of brain which precedes these conditions, when the stomach itself is the seat of the first morbid impression. This is an important practical fact; as a knowledge of it will serve to direct the attention of the physician, in many instances, to the true seat of the disease, which might otherwise be referred exclusively to the stomach.

Causes.—The most common immediate cause of vomiting is inflammation or irritation of the stomach. The result equally takes place, whatever may be the cause of the inflammation or irritation, whether offending matter in the stomach, vicissitudes of temperature, congestion of the portal veins, rheumatic or gouty disorder, translated cutaneous affections, spinal irritation, or direct sympathy with other organs in a state of inflammation. Evidence is very often afforded, as to the precise cause, by the nature of the substances vomited. If these be excessively sour, very acrid, or very bitter, the vomiting may in general be inferred to proceed from acid, bile, or other offending matter in the stomach; if they consist of mucus, or of substances swallowed not in themselves irritating, it may for the most part be ascribed to the morbid state of the stomach itself; and whether this be inflammation or irritation, direct or sympathetic, must be decided by the symptoms. But the ejection of bile must not always be considered as a certain evidence of its presence in the stomach, previously to the commencement of vomiting; for the pressure on the gall-bladder during vomiting, and the probable increase of the hepatic secretion during nausea, may cause an increased flow into the duodenum, the action of which viscus as well as that of the stomach is often inverted in emesis. Disease of the abdominal viscera, and of the uterus is very apt to occasion vomiting. So much is this the case that, in obstinate vomiting, the origin of which cannot be traced to disease of the stomach itself, attention should be directed to the liver, spleen, kidneys, &c., in order to ascertain the condition of these organs. In cases of this kind, it may result from an extension of irritation to the stomach through the ganglionic or spinal centres, or from an impression made by the diseased organs intermediately upon the brain. There seems to be a state of the nervous system, resulting from various causes, which disposes to that cerebral action essential to vomiting. Such a state results from violent spasm of internal organs, as of the biliary ducts, the ureters, and the bowels; from severe injuries produced by external violence, as by blows, falls, and sometimes even by surgical operations; from the loss of blood, the use of the warm bath, and other causes which induce faintness; from the depression attending the cold stage of idiopathic fevers; and from certain peculiar influences disturbing to the nervous system, such as occur in exanthematous fevers, pregnancy, and unaccustomed motions of the body, as in sailing, swinging, riding backwards in a carriage, &c. Disorders of the brain itself very frequently produce nausea and vomiting. Obstinate vomiting is one of the most characteristic features of hydrocephalus. Concussion and inflammation of the brain are frequently attended with it, as are also various functional derangements of that organ, producing giddiness or swimming of the head, cephalalgia, &c.

It would appear, from what has been said, that vomiting cannot always be considered as arising from gastric irritation; but that, on the contrary, it is not an unfrequent attendant upon great depression of the system. Even direct depression of the stomach itself would seem to be capable of producing it. Thus, draughts of tepid water often occasion nausea and vomiting, probably by their relaxing or depressing influence; for the same quantity, either hot, or cold, does not produce the same effect, proving that it is not by the stimulus of distension; and the temperature, being about the same as that of the stomach, cannot be the exciting cause. When the liquid is taken either hot or cold, the direct stimulus of the heat in the one case, and the indirect stimulus of the cold in the other, obviate the depressing influence of the liquid. The loss by the stomach of its ordinary mechanical support may give rise to nausea and vomiting. Hence, these effects have resulted from relaxation of the abdominal parietes, and have been relieved by a bandage.

Treatment.—It is obvious that, in the treatment of vomiting, regard must be had to the pathological condition upon which it depends, and remedies employed accordingly. Gastric inflammation or irritation must be relieved by the means pointed out under these heads. When the spine is in fault, the remedies must be addressed to that part. When the vomiting proceeds from the retrocession of external diseases, attempts should be made to recall the irritation to the surface or extremities by rubefacient, pustulating, or blistering applications. When it is a purely sympathetic affection, the real disease should be attacked in its proper seat. But there are certain modes of treatment, applicable to sick stomach under most circumstances, which it is proper to mention here, in order to avoid frequent repetitions.

Whenever there is reason to suspect that the vomiting is sustained by offending matters in the stomach, as for example when small quantities of bilious matter are thrown up at each effort, the stomach should be well cleared out by the free use of warm water, warm chamomile tea, chicken water, or other mild liquid, assisted, if necessary, by a moderate dose of ipecacuanha. In cases wholly free from inflammation, this treatment will often prove effectual, even though the vomiting may not depend upon the presence of an irritant. A tumbler full of warm water sometimes immediately settles a disturbed stomach, without being vomited.

After the stomach has been thus cleansed, if such cleansing should be necessary, the most efficient remedy, beyond all comparison, is opium. This may be given in the form of pill, of extract, of tincture, of camphorated tincture, of black drop, or of one of the salts of morphia. Dr. Chapman recommends a pill which has become hard by keeping. The camphorated tincture is peculiarly applicable to cases in which there is no vascular excitement of stomach, the black drop, or sulphate or acetate of morphia to others. The dose may be from the sixth of a grain to a grain of opium, or an equivalent quantity of its preparations, and may be repeated every hour or two if required. Should the remedy be rejected by the stomach, it may be given very advantageously by enema. An anodyne injection of from thirty to sixty drops of laudanum, with two fluidounces of thin starch or some mucilaginous liquid, is a most excellent remedy in vomiting. Should this be resisted, half a grain of finely powdered acetate or sulphate of morphia may be sprinkled upon a small blistered surface upon the epigastrium. In cases of great emergency, a denuded surface for the purpose may be obtained very speedily by the strong solution of ammonia, or by the careful application of nitric acid.

Next to the influence of opium in efficiency is probably revulsion to the epigastrium by means of rubefacients or blisters. An elegant cataplasm for the purpose may be made with equal parts of powdered cinnamon, cloves, ginger, and pepper, incorporated by means of warm spirit, and some adhesive substance, as honey or molasses. Flannels moistened with a decoction of Cayenne pepper in spirit, or with the oil of horsemint or of turpentine, may also be used, although the unpleasant smell of the latter oil is an objection to it. But the most effectual of the rubefacients is a sinapism made with pure mustard and water, which should be kept on from half an hour to an hour. When a lasting impression is required a blister may be resorted to.

Lime-water and fresh milk, in the dose of a tablespoonful of each every half hour, hour, or two hours, are very useful in cases where there is not too much excitement, where some nutriment is required, and especially where the stomach rapidly creates acid.

Carbonic acid water, either alone or sweetened with ginger syrup, is an excellent as well as agreeable remedy. It should be given occasionally as the patient wishes drink, in doses of one or two fluidounces, and each dose should be in a separate phial. When there is vascular irritation of stomach, it is best given without syrup, and very cold. A dose of the effervescing draught, made with carbonate of potassa and lemon-juice (see *U. S. Dispensatory*), given every hour or two, is especially useful in febrile cases. The Seidlitz powder, in one-sixth or a quarter of the ordinary dose, may be given under similar circumstances, and at similar intervals.

Different saline substances, besides those just mentioned, have been found useful by some practitioners in very small doses. Among them, common salt and sulphate of magnesia have been recommended. They may possibly sometimes prove useful by meeting some idiosyncrasy of the stomach, or by sustaining a slight peristaltic movement, and thus causing irritating secretions to pass downward.

In the absence of vascular excitement, and especially in cases of debilitated or depressed stomach, the various aromatics are often useful. That one should be selected which is usually most acceptable to the patient. Cinnamon, cloves, and nutmeg, are upon the whole best suited to this purpose. They should be given in infusion, or in the form of volatile oil, which may be administered in sweetened water, or preferably dissolved in water with the intervention of magnesia, as directed by the Pharmacopœia. Certain aromatic spirits or tinctures may also be used, in the dose of a fluidrachm. Such are the compound spirit of lavender, and the compound tinctures of cardamom and of cinnamon. I have found the aromatic spirit of ammonia, in the dose of fifteen or twenty drops, highly efficient in similar cases. It is an elegant addition to antacid mixtures, in cases of acidity connected with nausea and vomiting. Small quantities of brandy and water, spiced brandy, spiced wine, the sparkling wines, sulphuric ether, and Hoffmann's anodyne, have also been advantageously used in depressed states of the stomach.

Among the remedies which have been highly recommended for vomiting, when a mere functional disorder, is creasote in the dose of a drop, repeated occasionally. Some have found chloroform, given in doses of five drops, shaken in water, highly successful; and the same remedy applied to the epigastrium has been recommended. Injections of iced water into the rectum are asserted to have been very useful in vomiting connected with hysteria. Small doses of the tincture of nux vomica have been successfully used, especially in the vomiting of pregnant women; and frictions with extract of belladonna over the hypogastrium are recommended under the same circumstances by Bretonneau. It is sometimes necessary to obey the intimations of the stomach itself, which is occasionally quieted in this way when all ordinary measures fail. I have seen, for example, a patient at once cured of vomiting by roasted onions, which had been urgently and perseveringly called for, when the stomach rejected everything else that could be given, even a little cool water. (See *page* 213.)

Yeasty Vomiting.—There is a kind of vomiting, in which large quantities of a brown liquid are thrown up, generally very sour, which on standing soon begins to ferment, and covers itself with a thick coating of froth, closely resembling that of fermenting beer; the bulk of the vomited matter being thereby very greatly increased. On examination by the microscope, this matter has been found to contain the ordinary yeast plant, and, besides this, vast numbers of another microscopic fungus, named by Goodsir *sarcina ventriculi*, from its resemblance to a pack of wool. Dr. Todd, of London, has rendered it extremely probable that this kind of vomiting is dependent on and pathognomonic of enlargement of the stomach, with obstruction of the pylorus, whereby the food and other matters swallowed are retained, undergoing more or less chemical change, until, accumulating to an amount which the stomach can no longer tolerate, they are rejected. The pyloric affection may be carcinomatous, but probably is more frequently a cicatrix, or an existing ulcer with thickened submucous tissue. (*Lond. Med. Times and Gaz.*, July, 1854, p. 1.) *Sulphite of soda* was employed by Dr. Jenner as a remedy for this affection, upon a suggestion of Professor Graham, that sulphurous acid might be useful in the destruction of parasitic fungi. The free acid of the fermenting liquid decomposes the sulphite; and the sulphurous acid, being liberated, fulfils the requisite condition. The remedy has been found in many instances to produce the expected effect of destroying the sarcina, and partial relief has been afforded; but, as the presence of the fungus is a result of the condition which gives rise to the vomiting, and not the cause of the affection, the disease in general is not materially abated. The sarcina has, indeed, been found under other conditions, as in the stomach of diabetic patients without yeasty vomiting, in the bowels, the ventricles of the brain, the lungs, the bladder, and even the nostrils; but nowhere so abundantly as under the circumstances above referred to. The sulphite of soda may be given in the dose of a drachm three times a day, or oftener. But it is obvious that the cure must be effected, if at all, by measures addressed to the pathological condition of the stomach. I have had under my care a similar case in the Pennsylvania Hospital, which was discharged apparently well, after a treatment of several months with nitrate of silver.

Obstinate vomiting, after long resisting all other treatment, has been permanently removed by the occurrence of sea-sickness during a voyage.

Great thirst often attends vomiting, and the patient is constantly calling for drink; but he should be allowed to take only a very small quantity at one time.

Sea-Sickness.—This is a variety of vomiting so peculiar as to merit a separate notice. It may be considered as identical with the sickness produced on land by various unusual motions, such as riding backward in a carriage, swinging, rocking, or turning rapidly round as in waltzing. Sea-sickness differs only in its greater intensity and duration, which are attributable to the continued and unavoidable operation of its cause.

This affection is very often preceded by vertigo, and sometimes by headache. In some individuals there is a feeling of uneasiness, sinking, and great distress at the epigastrium, which is described as worse than vomiting, and which occasionally lasts for a long time. Sickness of stomach and vomiting, however, in general soon come on. The vomiting is frequent and exceedingly distressing, with convulsive heaving of the stomach which extorts groans from the patient. Along with this is a general feeling of wretchedness and prostration, which in bad cases is sometimes so great as to render the patient utterly inattentive to everything around him, and almost indifferent to life. The affection is usually harmless in its results, but has been known to prove fatal by inducing hemorrhage from the stomach, or wearing the patient out through protracted suffering. The probability is, that, in such cases, there has been previous disorder or morbid tendency, which was merely aggravated or called into action by the sea-sickness.

Individuals vary exceedingly in their susceptibility to this affection. Some are never attacked by it, others only in their first voyage, and others again in every voyage which they undertake. With some it continues but for a few hours or a few days, with others so long as they are at sea. Some persons, even long accustomed to the sea, are attacked with it whenever the waves are more than usually agitated. In most individuals, however, it occurs but once in the voyage, and continues only for a period varying from one or two days to a week. It is said that infants and very old people are rarely attacked, and that women are more susceptible than men. It almost always ceases immediately after landing.

The cause of sea-sickness is undoubtedly the motion of the ship; and the *pitching* of a vessel, or the alternate elevation and depression of the bow and stern, is most apt to produce it. The affection is most apt to occur when the ship is sailing against a head sea, or tossing in a calm, before the waves excited by the previous storm have subsided. It is least experienced in large ships, and in those heavily laden.

Various explanations have been given of the operation of the cause. The sickness has been ascribed to the movements of the abdominal viscera rubbing against each other. But this explanation would not apply to the similar affection occurring on land, and it is very doubtful whether, in most cases, any such friction occurs. Dr. Wollaston gave a purely physical explanation of the phenomena, which he supposed to proceed from the tendency of the blood to rise, and its consequent pressure upon the brain during the sinking of the ship, as the mercurial column in the barometer rises under the same circumstances. But this would not explain the occurrence of the affection in the horizontal position at sea, or from riding backward in a carriage. Dr. Darwin ascribed it to a disturbance of brain consequent upon the unusual impression produced upon the vision by the motions of the vessel; and Dr. E. Miller, of New York, coincided in this opinion, extending the explanation so as to embrace the sense of touch as well as that of sight. This is probably a correct view. The brain is thrown into a disturbed condition by the association of its present impressions, received through the senses, with the very different impressions previously received from similar objects; and this disturbance is exactly that which gives rise to the sensation of nausea and the act of vomiting. In support of this view, the facts may be adduced, that the disorder gradually ceases as the brain becomes habituated to the new impressions; that it is experienced in a less degree in the horizontal position, with the eyes closed, or in the dark, than under opposite circumstances; that it is diminished or obviated by intense engagement or pre-occupation of the mind; and, finally, that a somewhat similar effect is produced by certain deceptions of the senses, as when the eyes are directed to some fluctuating object, and the impression is conveyed that the body itself is moving.

Treatment.—From the foregoing statements it results that a person may diminish or obviate sea-sickness by assuming the horizontal position, especially in a hammock, and as nearly in the centre of the ship's movements as possible, and keeping his eyes closed. This is a desirable measure for very susceptible persons, on very short voyages; but would be too irksome under ordinary circumstances. It is better, as a general rule, to submit to the present transient evil, and thus gain immunity for the future. To alleviate the distress, it is recommended to fix the attention upon something calculated to interest it, and to assist, if admissible, in the active duties of the ship. Much may be done towards overcoming the tendency to sickness, by a determination not to give way to it, by keeping about instead of lying by, and by being as much as possible in the open air. Seamen advise the compression of the abdomen by means of a tight girdle. The patient may advantageously use acidulated drinks and liquids impregnated with carbonic acid. In severe cases, resort may be had to the various remedial measures mentioned under *vomiting*. Washing out the stomach, keeping the bowels regularly open, and the use of opiates, or diffusible stimulants, in small doses, have been especially recommended. The food should be easily digestible, and moderately taken. I have found nothing, under such circumstances, so acceptable to the stomach as raw salt oysters.

Sick-headache.—This is very often essentially a gastric affection, and therefore may be considered in this place.

Symptoms.—The pain in the head sometimes comes on abruptly, but is usually preceded by certain premonitory symptoms, such as confusion of head, vertigo, dulness, depression of spirits, irritability of temper, and perversion of hearing or sight, especially of the latter. There is often a glimmering before the eyes, or muscæ volitantes, or dimness; in some cases, objects are bordered with a halo of prismatic colours, in others are only half seen, and in others again appear double. Not unfrequently the patient complains of numbness or formication in the extremities, generally upon one side, and this numbness sometimes continues after the headache comes on. Coldness of the feet and hands, irregular pains in the back and loins, and deficient urinary secretion are also among the occasional premonitory symptoms. Sometimes the appetite is impaired; sometimes the patient eats a hearty meal immediately before the attack. The pain in the head is usually slight at first, and gradually increases until it becomes intense; but sometimes is violent from the outset. In the great majority of cases, it is felt in the forehead, over the brow, or in the eye, sometimes only on one side, but generally on both; and not unfrequently the eyeballs are sore to the touch. In some instances, the pain extends over the whole head, or is felt more especially in the back of the head or neck. It is often attended with chilliness, flushes of heat, and other deranged sensations; but the pulse is almost always natural or nearly so in frequency, and thus at once serves to distinguish the case from an attack of fever. The tongue is in some instances slightly furred. After the pain has continued for some time, nausea occurs, by which it is somewhat relieved; and there is often an alternation of severe headache and nausea for a considerable time, the latter gradually increasing, until at length vomiting takes place. The matters discharged are usually sour or bitter, but sometimes tasteless, especially if some antacid medicine has been taken. After vomiting freely, the patient usually falls asleep, and, having rested for several hours, awakes free from pain or nearly so. Should a dull pain in the head remain, it generally disappears after a meal, or upon exercise in the open air. The disease thus, in most instances, runs its course within a period of twenty-four hours. Sometimes, however, it is protracted with little abatement of violence for two or three days; the patient frequently vomiting during that period. In such cases, there is reason to think that the liver or head is involved otherwise than merely by sympathy with the stomach. Some persons suffer much less than others, having but a slight headache, which is very soon relieved by vomiting. Occasionally the attack subsides without vomiting, in consequence of the passage of the contents of the stomach downward. This is apt to happen if the patient fall asleep before vomiting. The paroxysm is occasionally interrupted by causes making a strong impression, whether on the mind or body. The attacks in some persons are rare, in others very frequent, occurring sometimes as often as once a week, with scarcely a complete freedom from pain in the intervals.

Causes.—In persons predisposed to sick-headache, slight causes are sufficient to induce an attack. It is brought on by the use of indigestible or acescent food, excess in eating or drinking, great bodily fatigue, loss of rest, extraordinary mental inquietude or exertion, exposure to cold when warm and perspiring, and by whatever else is capable of producing a morbid accumulation of acid in the stomach, or an excessive secretion of bile. The predisposition for the most part consists in debility of stomach, and a peculiar state of the nervous system, which renders the brain especially sensible to gastric irritation. Hence, all the causes of dyspepsia are predisposing causes of sick-headache. (See *Dyspepsia.*) It may be proper to mention here, as among the most prominent, the habitual use of coffee and tea, especially of the former. These nervous stimulants, when long and freely employed, have the indirect effect of diminishing the energy both of the stomach and brain, by the state of excitement which they produce in these organs; and their operation often escapes notice, because their immediate effect is not unfrequently to relieve, for a time, the affection resulting from their habitual use.

The pathological condition of the stomach, during the paroxysm, is irritation of the mucous membrane, induced either by an excess of acid, by undigested food, by acrid gastric secretions, by regurgitated bile, or by venous congestion resulting from a sluggish state of the liver. In the last case, neither acid nor bile, nor any other irritating matter, is necessarily vomited, and the hepatic secretion is proved to be deficient by the want of colour in the stools. Under all these circumstances, the affection of the brain is secondary. There is reason, however, to believe that this organ is sometimes the first recipient of the morbid impression, and that the stomach is secondarily involved.

Treatment.—This must be considered in relation first to the paroxysm, and secondly to the interval. The attack may often be prevented by proper measures applied upon the first appearance of the premonitory symptoms. The previous experience of the patient will generally serve as an index to the nature of the offending cause. If this be acid in the stomach, as happens in the majority of cases, from half a drachm to a drachm of magnesia will be found among the most effectual preventives. A drachm or more of the bicarbonate of soda may be substituted, when a laxative effect is not desired. These antacids may be elegantly administered in carbonic acid water, combined with a little ginger syrup, and a fluidrachm of some aromatic or tonic tincture, as the compound tincture of cinnamon, of cardamom, or of gentian. Twenty or thirty minims of aromatic spirit of ammonia will form a useful addition, when the stomach is considerably debilitated. If bile be the offending cause, some quick and gentle cathartic will be best adapted to the case; as half an ounce or an ounce of sulphate of magnesia, one or two Seidlitz powders, or a little infusion of senna. When the cause appears to be deficient hepatic action, a dose of calomel, with or without another cathartic, will be most efficient. Certain nervous stimulants also will frequently set aside the paroxysm, by obviating the sympathetic impression upon the brain; and they are especially serviceable when the affection is primarily cerebral. The best of these is perhaps strong tea. Coffee answers with some, but more frequently fails. Citrate of caffein, in the dose of a grain every hour has been recommended. A teaspoonful of Hoffmann's anodyne may be given for the same purpose. I have repeatedly known attacks of sick-headache to be averted by a fluidrachm of the solution of sulphate of morphia, in connexion with two or three drachms of sulphate of magnesia.

These same remedies may also be employed during the paroxysm in its earlier stages, and will sometimes set it aside even when fully formed. But, when nausea has commenced, it is generally advisable to promote the evacuation of the stomach by copious draughts of warm water, or warm chamomile tea, or a moderate dose of ipecacuanha. Free dilution with warm water sometimes settles the stomach, and favours a solution of the paroxysm. When the headache is severe, the patient should retire to bed, in a dark room, and keep as quiet as possible. He will thus sometimes fall asleep, and awake much relieved, without vomiting. Bathing the temples and forehead with spirit of lavender, Cologne water, or other aromatic spirit, sometimes affords relief; as also does the application of chloroform, or of sulphuric ether confined by the hand so as to prevent its rapid volatilization. Many, when they feel the paroxysm approach, prefer submitting quietly, and allowing it to have its course. Should the head not be relieved after the stomach has been fully evacuated, and the patient be unable to sleep, a dose of laudanum or sulphate of morphia may be given, and afterwards a cathartic. If, however, any evidence of cerebral congestion exist, the opiate should be withheld. In such a case, bleeding or leeching to the temples may be necessary.

In relation to the treatment in the intervals little need be said here. All those measures are indicated, which are calculated to strengthen at once the stomach and the nervous system. These will be fully treated of under dyspepsia. Among them none is more important than the removal of the predisposing causes. It has been stated that the habitual use of coffee and tea, especially the former, is one of the most influential of these causes. I have repeatedly known cures of sick-headache to be effected by an entire abstinence from coffee, where other means had failed; and one striking instance occurs to me in which an individual, after suffering long and severely with the disease, obtained an entire exemption by refraining from the use of black tea, which was his only indulgence. We cannot, therefore, too strongly urge an abstinence first from coffee, and, if this should prove insufficient, from tea also, even from black tea. These beverages, as has been stated, often operate advantageously as remedies in the paroxysm; but it is in consequence of those very properties which render their habitual use poisonous to some persons. Tobacco and alcoholic drinks, if habitually indulged in, should also be given up.

Various remedies have been extolled as peculiarly useful in this complaint. Thus, cider was recommended by Dr. Dwight, of Connecticut. (*N. Y. Med. Repository*, vol. 2.) This may prove useful in cases of idiosyncrasy, but is not generally applicable. Dr. Otto, of Philadelphia, cured a very obstinate case by the long continued use of the solution of arsenite of potassa in doses of about three drops three times a day. (Mease *on Sick-headache.*) In cases where the paroxysm returns at regular intervals, as sometimes happens, sulphate of quinia will often effect at least a temporary cure. Should the biliary secretion be habitually deficient, a mercurial pill, or a grain of calomel, should be given every night, or every other night, followed by a laxative next morning, and continued till the evil is corrected.

Morbid Appetite.—There are two forms of morbid appetite, one in which the desire for food is abnormally increased, the other in which it is directed towards unusual objects. In the former case, it is said to be *voracious*, in the latter, *perverted* or *depraved.*

1. *Voracious Appetite.—Voracity.—Canine Appetite.—Boulimia.*—There are various degrees of this affection, from a slight increase beyond the point of health, to a constant and insatiable craving for food. Cases are on record in which the patient when awake was never content unless eating, and in which an almost incredible amount of food was consumed. Dr. Mortimer, in the 43d volume of the London Philosophical Transactions, relates the case of a boy of about twelve years, who, in six successive days, took a quantity of different kinds of food weighing three hundred and eighty-four pounds eight ounces, equal to about sixty-four pounds a day. In such cases, when food is withheld, there is a feeling of uneasiness, inquietude, or even faintness, with an indescribable vacuity or sinking of stomach, a sort of craving void, which impels the patient to seize voraciously upon everything in the shape of food, however unsuitable or ordinarily repulsive, and even to gnaw his own flesh if not indulged. Individuals with this propensity are usually thin and even emaciated; although, in some instances, the food serves the purpose of an increased nutrition, and enormous obesity is the consequence. In cases of the former kind, the food is sometimes vomited, and sometimes passes quickly through the bowels, without undergoing digestion. Occasionally it is rapidly digested, and is converted into chyle and blood, but merely serves to supply materials for hemorrhage, or some extensive excretion, as that of perspiration or urine.

If it be considered that hunger is a sensation, which, though always referred to the stomach, and often originating in that organ, may be equally produced by impressions sent to the brain from the capillary vessels all over the body, when in want of supplies for the nutritive function, it will be easily understood that voracious appetite may depend either upon a disordered condition of the stomach, or upon the state of the nutritive function in general. Hence, we find it as a consequence sometimes of a kind of gastric irritation, proceeding from stimulating secretions in the stomach, sometimes of a deficiency of nourishing matter in the blood-vessels, or of an unusual energy in the nutritive process. Hence the voracity of persons who have long fasted, and of those convalescing from diseases in which there has been great loss of flesh. Hence, too, the occasional morbidly increased appetite of anemic patients; and of those affected with a tendency to excessive obesity, and with wasting diseases and profuse evacuations, as consumption and diabetes. The affection sometimes also arises from disordered innervation of the stomach, produced by causes disturbing the nervous system in general, as in hysteria and the early stages of pregnancy. To the same head may also be referred the effect ascribed to worms in the bowels, especially to the tape worm, of producing a voracious appetite. In some of the worst cases, the disease depends upon original or accidental irregularities in the structure of the stomach. Thus, it has been attributed to a preternatural capacity of that organ, and to an enlargement of the pyloric orifice, allowing the food to pass undigested. Of the same character are cases in which the stomach communicates directly with the colon. The habit of indulging the appetite to excess leads no doubt frequently to a morbid craving. Lastly, boulimia may be a cerebral affection; a species of insanity, in which the sensation of hunger originates in the brain itself, exactly as in the case of nausea, which frequently arises directly from cerebral disorder.

Little need be said upon the treatment of this affection. In cases arising from malformation of stomach a cure is not to be expected. As a palliative, compression of the abdomen by a tight band has been recommended. When the complaint depends upon any morbid state of the system, or an organ, our remedies must be addressed to the primary disease. Direct irritation of the stomach must be combatted in the modes already detailed. Perhaps, in some cases, advantage may be derived from sustaining nausea for a considerable time by means of emetic medicines in small doses. In the excessive appetite which follows long fasting, and attends convalescence, it is often highly important to restrain the propensity; as much danger sometimes results from over-indulgence. In the gluttony of habit, on the contrary, there is danger from too sudden a withdrawal of food. The system sometimes sinks rapidly and unexpectedly in such cases, as from the sudden withdrawal of stimulating drinks. Hence gluttons, like drunkards, are in peculiar danger from diseases which take away the appetite, and thus cut off the usual supply. The practical inference from this fact is, that any attempt to cure an established habit of over-eating should be gradual.

Depraved Appetite.—Pica.—In this affection there is a desire, often irresistible, for strange articles of food, for substances wholly unfit for food, and sometimes for things offensive or even disgusting. These whims of the appetite are exceedingly diversified, and there is scarcely any object in nature to which they may not be directed. Thus, instances are on record of persons having a propensity for spiders, toads, serpents, candles, paper, human excrement, earthy matters, as clay, chalk, and magnesia, and even hard, wounding bodies, as stones, pieces of glass, pins, needles, and blades of knives. Such vagaries are often temporary, and of little importance; but they are sometimes durable, and cease only with life; the patient falling a victim either to the disease of which the depraved appetite is merely a symptom, or to the chronic gastritis, and general disorder produced by its indulgence.

Like voracity, this affection may depend upon some form of gastric irritation, upon inscrutable changes in the innervation of the stomach, upon cerebral disorder amounting to a species of insanity, or upon mere habit. The form of depraved appetite, which seeks indulgence in the eating of clay, chalk, &c., is probably often connected with acid in the stomach, which is neutralized by the substance swallowed. It is possible that, in some of those cases in which hard, rough, or pointed bodies are swallowed, the propensity depends upon that insupportable feeling of vacuity in the stomach, which is relieved by the pain or excitement these bodies may produce. Depraved appetite occurs most frequently in children, and in chlorotic, hysterical, or pregnant females. The whimsical fancies of pregnancy are universally known.

The general observations upon the treatment of voracious appetite are applicable here. To obviate, as far as possible, every observable disorder of function is the chief indication. In cases strictly and exclusively gastric, an emetic followed by cathartic, antacid, and tonic medicines, with wholesome digestible food, and the various other measures calculated to invigorate the stomach, are the remedies from which most advantage may be anticipated. (See *Dyspepsia.*)

Article IV.

INDIGESTION, or DYSPEPSIA.

Under this name have often been confounded various morbid states of the stomach, such as chronic gastritis, irritations of all kinds whether vascular or nervous, and different forms of gastric depression or debility. A consequence of this confusion has been serious error in practice; a set of rules applicable to a particular condition, having been too frequently extended, without discrimination, to others wholly different. The name is unfortunate; as, instead of expressing a particular pathological state, it merely refers to a result which may flow from different and even opposite conditions of the stomach; and it is not improbable that much of the confusion alluded to has arisen from this cause. It has been questioned, whether there is any distinct gastric disorder, not included under other recognized titles, to which the name of dyspepsia properly belongs. Broussais and his disciples referred all those affections usually called dyspeptic to gastric irritation or inflammation. But this view has not generally prevailed. Cases frequently occur, in which it would be impossible to trace all the phenomena to this origin. It can scarcely be doubted that a depression of the actions of the stomach, or a diminution of its power, constitutes, in many instances, the basis of a distinct pathological state, entitled to rank as a disease. It is to this state that I propose to restrict the name of dyspepsia. With the depression or debility are undoubtedly very frequently associated different forms of irritation, and even inflammation; but these are incidental complications, and, when removed by appropriate measures, still leave the original disease. As dyspepsia actually occurs, the phenomena are consequently of a mixed character, though an accurate observation will usually discriminate those which belong to the proper disease, from those produced by the associated affections.

Symptoms, Course, &c.—Dyspepsia does not in general come under the notice of the physician, until it has existed for a considerable time. The symptoms which it then presents are very different in different cases. One of the most prominent is a feeling of vague uneasiness in the epigastrium, which is not pain, and is often worse than pain, so that the patient sometimes strikes himself over the stomach, or upon the side, in order to obtain relief by changing the sensation. This feeling is usually diffused over the epigastric region, and often extends to the hypochondria, to the chest, especially on the left side, and even to the shoulder, and down the arms. The uneasiness is greatest when the stomach is empty, and is often replaced, after eating, by a sense of fulness, distension, or weight. Besides the peculiar feeling referred to, there is not unfrequently a sensation of heat, a burning or gnawing pain arising from vascular irritation of the stomach, and sometimes spasmodic and gastralgic pains, and a sense of distension from flatulence or other causes. Frequently, along with the debility of stomach, is an increase of sensibility from deranged innervation, in which case substances swallowed may occasion acute pain, and the epigastrium evinces considerable tenderness on pressure.

The appetite is usually more or less impaired, and is sometimes wanting, constituting *anorexia*. In other cases, again, it is craving, or perverted. (See *Morbid Appetite.*) There is seldom a healthy feeling of hunger, but, in place of this, the patient very commonly experiences a sensation of hollowness or sinking at the epigastrium, when the stomach is empty, which leads him to wish for food. Thirst is not unfrequent.

Eructations of wind, and regurgitation into the mouth of food or chyme, or of a sour, bitter, acrid, oily, or offensive liquid, are common symptoms. Some patients are affected with water-brash (see *Pyrosis*), and some with occasional or habitual vomiting.

The phenomena hitherto mentioned belong more especially to the stomach. There are also numerous symptoms, having their seat elsewhere, which depend on derangements either consequent upon those of the stomach, or produced by an extended operation of the same cause. Among these are various disordered sensations, such as headache, giddiness, and heaviness of the head; muscæ volitantes, and other results of perverted vision; tinnitus aurium, and other unreal sounds (see *Sick-headache*); irregular pains between the shoulders, in the back, and other parts of the body; a feeling of coldness between the shoulders; stricture, or uneasiness about the throat; and irritation in the larynx and fauces, leading to frequent attempts to clear the throat, which at length become habitual. There is often also general uneasiness or malaise, a tendency to low spirits, a feeling of indifference or of anxiety and apprehensiveness, an indisposition to exertion, irritability of temper, fretfulness, &c. The patient is apt to imagine himself affected with consumption, organic disease of the heart, or some other incurable malady. Palpitations of the heart, coming on at uncertain intervals, dyspnœa, and a short dry cough, are not unfrequent symptoms, and tend to confirm these melancholy impressions. The patient in general sleeps badly, is disturbed by unpleasant dreams, sometimes by nightmare, and awakes unrefreshed, and depressed in mind. In some instances, however, the sleep is sound, and affords almost the only interval of ease; and in others again, there is even a morbid tendency to drowsiness. The tongue is usually somewhat furred, especially in the mornings, and there is often an unpleasant taste in the mouth, as if the saliva were sour. In some cases there is frequent hawking, with a discharge of frothy mucus from the fauces.

The bowels are almost always constipated, unless in cases complicated with chronic enteritis, or excessive secretion of bile. The hepatic function is also frequently deranged. The secretion of bile is very often diminished, giving rise to light clay-coloured, whitish, or hard and scanty stools. Sometimes it is perverted, giving a dark or black colour to the passages, and more rarely is too abundant, producing vomiting of bile, or bilious diarrhœa.

The *surface* is usually dry, and of irregular temperature. The feet and hands are often obstinately cold, but sometimes hot and even burning, especially at night. In debilitated cases, instead of dryness of skin, there is sometimes copious sweating. The *urine* is variously affected, sometimes scanty and high coloured, depositing a lateritious or whitish precipitate, sometimes copious, limpid, and almost colourless. The *pulse* is in some cases quite natural, in others more or less disordered, being either too slow or too frequent, or altogether irregular. In some patients it is very irritable; being slow and regular under ordinary circumstances, but thrown into great disorder by slight causes of excitement, whether bodily or mental. In such persons, it is apt to be rendered very frequent by exertion in the morning.

The symptoms above enumerated are by no means all present in every case. They are combined in almost infinite diversity; and there are scarcely two cases in which striking differences might not be observed. At first, the disease usually exhibits itself in slight paroxysms, with intervals of almost entire exemption. These attacks are little noticed, and gradually increase in duration and frequency, until at length the patient is seldom without some evidences of disorder.

The patient usually loses flesh, and sometimes becomes much emaciated, with flabby muscles, a sunken abdomen, a pale sallow skin, and an anxious expression of countenance. The disease, however, seldom proves directly fatal. In the vast majority of cases, the patient either recovers entirely, or so far as to have only occasional returns upon a renewed application of the cause. In others, the disorder, which was at first purely functional, becomes organic; chronic gastritis is established; and the patient sometimes sinks under the combined influence of debility and irritation. The chief danger from dyspepsia, however, is, that the reduced strength of the system may disable it from surmounting other intercurrent diseases. It is possible that, as maintained by Wilson Philip, functional sympathetic affections of the liver, the lungs, &c., having their origin in dyspepsia, may become organic diseases, and constitute the chief source of inconvenience and danger; but my observation would lead me to the conclusion that such cases are very rare. The predisposition to phthisis may be favoured by the debility attendant on dyspepsia, as it is by the same condition from any other cause; but the former disease is probably seldom or never the direct result of the latter.

It is important to distinguish chronic gastritis from dyspepsia, and to be able to recognize inflammation when it takes place in the course of the latter affection. In chronic gastritis, the pain is on the whole more severe, the epigastric tenderness greater and more constant, vomiting much more frequent, and the pulse more tense, and, as a general rule, more accelerated. In this complaint, the tongue is frequently red, with prominent papillæ or altered surface, which is seldom the case in pure dyspepsia. Hot and stimulating drinks increase uneasiness in the inflamed stomach, while they often afford relief to the dyspeptic; and food is in general more acceptable to the latter than to the former. When the matter vomited is mucus, or blood, or like coffee-grounds, the existence of chronic gastritis may be inferred. Febrile action, and diarrhœa, are also much more common in that complaint than in dyspepsia. When, therefore, in a case of indigestion, the various symptoms mentioned increase or become developed, there is good reason to believe that gastritis has supervened.

Causes.—The most prolific source of dyspepsia is probably the combined influence of sedentary habits and errors of diet. A certain amount of exercise is necessary to support every part of the body in due vigour; and the stomach consequently participates in that debility which results from the want of it. If the quantity and quality of the food were in proper relation with this reduced energy, the whole system might remain enfeebled, but the stomach would not especially suffer. The fact, however, is, that, while the gastric energies are impaired by sedentary habits, the diet is scarcely modified, and the quantity of the food taken, and its quality are those adapted to undiminished powers of digestion. Hence it results that the weakened stomach is stimulated to undue exertion in order to effect the process of chymification, and falls subsequently into a proportionate degree of languor; and this alternation, being continued with a steadily diminishing energy of stomach, and a steadily increasing disproportion between its power and the task it has to accomplish, ends at length in the production of a permanently morbid gastric depression, below the general standard of action for the rest of the system, thus constituting dyspepsia.

The habitual use of food, peculiarly difficult of digestion, has the same effect in a healthy stomach, producing an indirect debility consequent upon excessive excitement. Larger quantities of food than the stomach can well manage operate injuriously upon the same principle, and, additionally, by weakening the muscular coat through over-distension. Food insufficiently masticated operates in like manner as indigestible food, by affording a mechanical impediment to the action of the gastric juice. The habit of rapid eating conduces to the same end, partly through imperfect mastication, but still more by overloading the stomach, which is unable to appreciate the quantity of food received, in consequence of the rapidity with which it is swallowed, and does not, therefore, communicate to the palate the feeling of satiety at the proper point of time. In speaking of indigestible food, it must be borne in mind that the term is relative, and always has reference to the energy of stomach; those articles often being easily digested by a person accustomed to unusual bodily exertion, which are difficult of digestion by ordinary persons, and are almost indigestible by a weak stomach.

The excessive use of alcoholic liquors, opium, or other cerebral or nervous stimulants, especially strong coffee and tea, produces dyspepsia, in the same manner as indigestible food, by calling the stomach into excessive action, and thus occasioning secondary depression, and ultimate loss of power, by the exhaustion of the excitability. The spices used largely as condiments have a similar effect, though less in degree, because they operate less upon the nervous functions.

Whatever calls off nervous energy from the stomach, by concentrating it strongly elsewhere, depresses the gastric actions, and favours the production of dyspepsia. Intense and protracted study, or other absorbing mental occupation, has this effect; and young students, therefore, who are usually at the same time sedentary, and indulgent to their appetites, are peculiarly liable to the disease. Excessive and exhausting exercise, by directing excitement to the muscles, has the same effect.

Among the causes of dyspepsia must also be enumerated those which have an immediate depressing action upon the stomach. Such are the sedative narcotics, as tobacco; large quantities of cold drinks, when the stomach has little power of reaction; large draughts of lukewarm water; and especially the depressing emotions, as grief, anxiety, and fear.

Pathology.—From what has been said, it will appear that pure dyspepsia consists essentially either in depression of stomach, arising from the withdrawal of its ordinary supply of nervous influence, or from some immediate sedative influence upon it, or in positive debility, from the loss of excitability, consequent upon excessive stimulation. In either case, the stomach performs less efficiently its appropriate function. In the process of chymification, it exercises two offices, *first*, the secretion of gastric juice for the solution of the food, and *secondly*, the admixture of the food with the juice, by its peristaltic movements. In its state of comparative inaction, there is less of the solvent secreted, and less of the muscular movement to favour solution. When, therefore, nutriment is introduced, especially such as is difficult of digestion, it remains longer than usual undissolved, and sometimes is not dissolved at all. It thus comes within the influence of its own chemical affinities, decomposition takes place, and new substances are formed, among which acid and gaseous matters are predominant. Hence, in part, the flatulent eructations, and the regurgitations of acid, so common in dyspepsia. But a diminution of the gastric secretion is not the only result, in relation to that fluid. It is also altered in quality, in consequence of the deficient energy of stomach. Thus, from being a comparatively bland liquid, it becomes acrid and irritating. This altered secretion, the undigested food remaining as a foreign body in the stomach, and the acid, &c., resulting from its fermentation, all co-operate in producing vascular irritation of the mucous membrane, and often also a sympathetic nervous irritation of the muscular coat. Hence the heartburn, the occasional gastralgia and spasm, and frequently the headache and vomiting of dyspepsia. The peculiar epigastric uneasiness, characteristic of the disease, arises probably from defective innervation, like the exceedingly disagreeable feeling often experienced in a partially palsied limb. The weight, oppression, &c., after eating, is the obvious result of undigested food, acting upon a surface too feeble to respond in the usual manner by an increased secretion of gastric juice, and the removal, through its means, of the offending cause. Sometimes the food occasions suffering in consequence of the increased sensibility to painful impressions, which not unfrequently attends upon the debilitated state of an organ.

Along with the gastric depression or debility, a similar condition is often produced either by the action of the same causes, or by sympathy with the stomach, in the bowels, the liver, and perhaps the pancreas. Hence the diminished or vitiated secretion of bile, and the constipation of bowels. Hence, too, in all probability, the portal congestion which sometimes complicates dyspepsia. The diversified nervous disorders attendant upon the disease are ascribable, partly to the simultaneous operation of its causes upon other parts of the system, as well as upon the stomach, but chiefly to the extended and intimate sympathies of this organ. Should the disease not give way, the repeated vascular irritation, from the causes already enumerated, at length ends in inflammation, which is so much the more difficult of cure, as the debility both of stomach and system forbids the energetic employment of the most effective antiphlogistic measures.

Treatment.—In the treatment of dyspepsia, the first and by far the most important indication is the removal of the causes. The measures requisite for this end, embrace the regulation of the diet, the exercise, and the general habits of the patient, moral as well as physical.

Diet.—The most obvious rule, in relation to diet, is to avoid the use of all substances of difficult digestion. To be practically useful, however, the direction must be more precise, and embrace an enumeration of the particular substances to be forbidden or allowed. The following specification is only correct in general; for the peculiarities of individual stomachs are so numerous, that an article easily digestible by one will often prove almost indigestible by another, and *vice versâ.*

The patient, as a general rule, should avoid all culinary vegetables, with the exceptions hereafter to be mentioned; all fruits, whether fresh, preserved, or pickled; all fat, salted, and smoked meats, and those which are tough, from whatever source derived. Of the particular kinds of animal food, pork, pig, veal, and domestic ducks and geese, are peculiarly difficult of digestion. The flesh of very young, or of very old animals, is usually less digestible than that of the same animals in the intermediate stages of life. Fish is generally deemed of difficult digestion; and most shell-fish, especially clams and lobsters, should be avoided by the dyspeptic. Of substances prepared by the culinary art, pastry; fresh, hot, and heavy bread; puddings; cakes made with butter or fat; fried meats; hard-boiled eggs; jellies; soups; gravy; and all sorts of dressings with butter, sugar, wine, &c., should be forbidden. Whatever is pasty, doughy, or disposed to form a tenacious mass with water, resists digestion, because impenetrable by the gastric juice. Sausages, and cheese of all kinds, are of difficult digestion. Butter, lard, and other fats, when altered by heat, are very injurious to the dyspeptic stomach. Brown sugar, molasses, and honey are apt to induce acidity. Vegetable acids have been found to be generally injurious; and the fruits which contain them largely should be especially avoided.

The list of allowable substances is not scanty. Among those of vegetable origin are wheaten bread, which should always be light, stale, and perfectly free from acid; crackers, made without shortening of any kind; well-boiled rice; and Irish potatoes, either roasted or boiled so as to be dry and mealy. Some object to the last mentioned vegetable, and the small, waxen or watery potatoes which are often met with are certainly of difficult digestion; but, when of good quality, they agree well with most dyspeptic stomachs. The sweet potato, when dry and mealy, though sometimes flatulent, is often very acceptable, and may always be tried, when the patient desires it. Tomatoes, well prepared without butter, are found to agree with many individuals, and prove useful by their laxative property. The same may be said of perfectly ripe, and sweet free-stone peaches, and perfectly ripe blackberries or dewberries. But all these fruits may, as a general rule, be placed in the category of doubtful substances.

Good fresh milk, boiled or unboiled, is usually easily digested, and forms an excellent diet for dyspeptics, especially when stronger animal food may be thought hazardous, in consequence of existing or suspected chronic gastritis. It forms a good dessert when loosely coagulated by means of rennet, and mixed with refined sugar, nutmeg, and a little sound wine. Small quantities of sweet cream may be taken with propriety, and even agree with some stomachs which most other food offends. The same may be said of pure ice-cream, flavoured with vanilla. This forms a very good dessert for dyspeptics; but should always be eaten very slowly, and allowed to dissolve perfectly in the mouth, before being swallowed. Good fresh butter, though condemned by some writers, has, within my observation, when eaten moderately with bread, rice, potatoes, &c., proved in general perfectly innocent. But there is a vast difference in this product, and, when badly prepared, or in the slightest degree rancid or musty, it is as offensive to the stomach as it is to the delicate palate. It should never be used in dyspepsia after having been subjected to any culinary process; as heat has a very injurious effect upon it.

Among the meats, tender mutton or beef, and among poultry, the common fowl or turkey is to be preferred. The flesh of wild animals is in general more easily digested than that of the tame. Good venison is perhaps the lightest and most digestible of meats. The American pheasant and partridge, and the canvass-back duck, with many of the smaller birds, are admissible articles. But in eating all sorts of fowl, care should be taken to avoid the skin and fat, especially when they are roasted; and the fat of all the meats which have been mentioned should be rejected. Both meats and poultry should be kept for some time after being killed, before cooking, so as to lessen the tenacity of the muscular fibre; but they should never be allowed to be in the least tainted. They should be either boiled, roasted, or broiled. When there are symptoms of even slight gastric inflammation, if flesh is used at all, it should be preferred boiled.

There are various other articles of animal food, well adapted to dyspeptic patients; such as oysters, raw or slightly roasted; sweet-bread; the liver of calves; terrapins, cooked well without butter; and soft-boiled eggs. It is highly necessary that eggs should not be overdone. They should be so prepared that the albumen may be coagulated, while the yolk remains liquid. This is accomplished by placing them in boiling water, and keeping them in it for three minutes. The yolk of eggs may also be prepared by beating it up raw with water, sugar, and a little ginger. This mixture is well adapted for those whose stomachs will not allow them to pass the whole interval between the regular meals without food. Although, as before mentioned, salted and smoked meats are usually injurious as articles of diet, very small quantities of chipped very tender dried beef or venison, or boiled ham, or a little smoked herring, may be employed with impunity for relish.

Condiments, such as salt, mustard, black and Cayenne pepper, horse-radish, &c., should always be used with moderation. They occasionally prove beneficial by assisting digestion; and, as their stimulant effects are chiefly local, they are less dangerous than alcohol; but, like all other stimulants, if abused, they diminish the excitability, and thus increase the already existing debility.

In relation to drinks, the best, upon the whole, is cool water. The vinous and spirituous liquors, though they often afford temporary relief, are positively injurious if constantly used, and always place the patient in the danger of acquiring intemperate habits. Should any one of them be employed, it should only be at dinner; and sherry or madeira among the wines, and brandy among the spirits should be preferred. Some stomachs bear sound ale or porter pretty well, in moderate quantities. For the morning and evening meals, an infusion of the chocolate nut, with a little sugar and milk, or a cup or two of not very strong black tea, may be used; though water alone, or a mixture of milk, sugar, and hot water, would perhaps be preferable. Coffee should never be taken, unless occasionally, in small quantity, as a pleasant nervous stimulant, immediately after dinner.

It must be remembered, however, in regulating the diet of dyspeptic patients, that the stomach is singularly capricious, and sometimes takes fancies, which, however contrary to preconceived opinion, it may be proper to indulge. Such fancies, when they persist for a considerable time, are usually signs by which nature indicates her wants. Numerous instances have been noticed, in which patients have been benefited if not cured by the use of articles of food, which, under ordinary circumstances, are highly indigestible. Experience, moreover, will often be a better guide, in any particular case, than general precepts. Care, however, must be taken that the judgment of the patient be not biased by his inclinations or prejudices. (See *Pointings of Nature*, p. 213.)

Almost as much depends upon the proper mode of taking food as upon the selection of the substances to be used. The patient should, as a general rule, eat at regular intervals, and three meals a day are usually sufficient. The stomach should be allowed some rest; and the habit of eating little and often through the day, as well as at bedtime, so that the stomach may be as seldom as possible quite empty, is not advisable. In some cases, when the interval between breakfast and dinner is long, and the patient suffers much from an empty stomach, a few oysters, a little egg prepared in the manner above mentioned, or some other light food, may be taken about two hours before the latter meal. Large suppers are very injurious, as they overtask the digestive organs at a time when their energy is least. Great care should at all times be taken not to overload the stomach. On this account the patient should eat slowly; as the stomach will be more likely to give the signal of satiety at the proper time, when permitted to feel the full influence of the food as it is swallowed. Besides, it is important that the food should be thoroughly masticated, so as to favour its solution; and this is prevented by rapid eating. A meal should never be taken immediately after fatiguing exercise; as the stomach participates in the general languor. The patient should not drink largely, especially at meals. Besides the injury from distension, the solvent power of the gastric juice is diminished by too great dilution.

Exercise.—The great object of exercise is to equalize excitement, so that each organ may have its due supply of blood and of nervous influence. This is accomplished by a combination of passive and active exercise. By the former the viscera are especially acted on, by the latter the whole of the voluntary muscles and the structures associated with them in function, while both affect the nervous system. Of the different kinds of passive exercise, the best, as a general rule, for the dyspeptic, is riding on horseback; the next best, riding in a somewhat rough vehicle, or over a rough road, as in one of our stage-coaches over a stone turnpike. These, however, will be found too severe for some very delicate persons, especially those in whom there is a nervous tenderness of stomach. For such persons, driving in an ordinary carriage, or travelling on railroads, or sailing, may be substituted. Of the modes of active exercise, walking is best for persons somewhat advanced in life; running, leaping, &c., may be practised by the young. Gymnastic exercises are also useful; but care is necessary to avoid the temptation of carrying them to extremes. In bad weather, and for persons who cannot conveniently leave their homes, exercise of various kinds within doors should be contrived. The ordinary household duties afford abundant opportunities for active exercise to females. When the patient cannot command the means or opportunities for riding, he may substitute the plan recommended by Halsted, or some analogous one, for giving passive exercise to the stomach. This consists in bending the body forward, and so relaxing the abdominal muscles as to allow the hands to be pressed with their palms upward beneath the stomach; and then, by gentle and repeated impulses with the fingers, keeping up a regular movement in that organ. It should not, however, be practised when the process is painful, or there is any reason to suspect inflammation of the stomach. It often affords relief in flatulence.

Exercise should be as regular as possible, and promptly timed in relation to the periods of eating. Violent exercise should never be taken immediately before or immediately after a full meal. I am disposed, however, to believe, with Dr. Beaumont, that gentle exercise after eating, especially of the passive kind, rather promotes than interferes with digestion. (*Exp. and Obs. on the Gastric Juice, &c.*) In taking exercise, the dyspeptic should always stop short of great fatigue. It is important that this remedial measure should not become irksome to the patient, and, therefore, that some other immediate object should if possible be associated with it, besides the mere promotion of health. It is always desirable to connect it with the pursuit of interest or enjoyment. Hence one of the advantages of travelling.

General Habits.—The patient should observe regularity and moderation in all his habits. Excesses of all kinds are injurious to the debilitated stomach. He should retire early to bed and rise early, allowing from six to eight hours for sleep, and never permitting either pleasure, business, or study, to encroach upon his period of rest. The sleeping apartment should be well ventilated, and mattrasses used in summer instead of feather beds. Nevertheless, it would be injurious to sleep so lightly covered as to suffer in the least from cold. It is a mistake in dyspeptic individuals to suppose that they can harden themselves in this way. Personal cleanliness should be rigorously observed; but the too frequent or long continued use of baths, especially of warm baths, is injurious by their sedative or relaxing influence. The cold bath, or shower bath, is to be preferred when a vigorous reaction follows. This, indeed, is an excellent remedial measure in dyspepsia. But, when the system is too feeble to react thoroughly, the tepid bath must be used; and the patient should remain in it no longer than is necessary for cleanliness. When the skin is in a cold, languid state, the warm salt-bath will often be found useful; and friction to the surface, by means of a flesh-brush, or coarse towel, should be employed daily. Friction over the abdomen is highly advantageous. The patient, moreover, in employing this measure, has the additional benefit of wholesome exercise.

Relaxation from severe study, and from the cares and anxieties of harassing business, of whatever kind, is essential to the cure of dyspepsia. Yet the mind must not be left without occupation; as in no disease is it more apt to prey upon itself, when surrendered wholly to its own caprices. Innocent amusements, cheerful society, light reading, and moderate professional occupation, have a very healthful influence. Sources of mental depression should always, as far as possible, be removed or counteracted. All these objects can be accomplished in no other way so effectually as by travelling, which unites the advantages of exercise, pure air, relaxation from care, and agreeable excitement of the mind; and, if directed to some suitable watering-place, affords the additional advantage of an efficient medicinal agent. To render a journey permanently useful, it must be a long one; and hence a voyage to Europe or some foreign country, and an absence of six months, a year, or more, are among the most effectual means of curing dyspepsia. It is probable that the effect produced on the stomach by the sea-sickness, and consequent abstinence is advantageous in many cases.

Medicinal Treatment.—Two principal indications are presented in dyspepsia for the use of medicines; first, to keep the bowels regularly open, and secondly, to make a moderate, but durable stimulant impression upon the stomach. The former is to be accomplished by laxatives or enemata, the latter by tonics. It has been recommended to commence the treatment with an emetic of ipecacuanha. This, however, is called for only in certain incidental conditions; as when serious inconvenience is experienced from offending matters in the stomach, or where it is desirable to arouse the languid portal circulation, and thus remove congestion. If emetics should be employed merely for stimulating the stomach, little permanent effect could be expected from them, unless occasionally repeated; and the danger of irritation might, in this case, be greater than the chance of benefit. In general, therefore, it is safest to dispense with them.

It would be desirable to maintain regular alvine evacuations by means of diet alone; but unfortunately the articles of food best calculated for this effect, such as the fruits and fresh vegetables, are inadmissible from their difficulty of digestion, and aptness to occasion acidity and flatulence. Bran bread, or bread made from unbolted flour, is not liable to this objection, and constitutes, on account of its laxative quality, an excellent article of diet for dyspeptics. It does not, however, suit all stomachs, and frequently fails in producing the effect desired. When medicines are employed, those should be selected, as a general rule, which have no tendency to weaken the stomach, but on the contrary unite a tonic or stimulant with their laxative power. Rhubarb and aloes are the most suitable. They may be given separately or combined; and the most convenient period for administering them is generally at bedtime, so that they may act in the morning. Rhubarb may be used in all cases; aloes in all, when there is no tendency to piles or uterine irritation. Combination with soap is thought to render them milder, without impairing their efficacy. They are usually given in pill; but many persons are in the habit of chewing rhubarb, or of taking it reduced to powder by grating. In the latter case, it may be advantageously associated with grated nutmeg. When these medicines lose their effect by repetition, they may be mixed with a minute proportion of croton oil. One-sixth of a drop will often be sufficient to communicate to them the requisite activity. I have found a small teaspoonful of Cheltenham salt, taken half an hour or an hour before breakfast, in half a tumblerful of water, to be an admirable laxative in some cases of dyspepsia. A draught of Saratoga water, taken at the same time, also answers a good purpose. A drachm of sulphur, once or twice a day, is especially useful in cases complicated with rheumatism. White mustard seeds unbruised, in the dose of a tablespoonful, repeated as often, have been found to answer well in cases requiring a somewhat stimulant impression. Magnesia should be employed when there is acidity of stomach. Mild laxative enemata or suppositories, applied daily, are sometimes usefully substituted for cathartics by the mouth. In general, however, they do not sufficiently affect the upper bowels.

Tonics must be used with caution. If largely employed, and long and steadily persevered in, there is danger that they may wear out the excitability of the stomach, and thus indirectly increase the debility they were given to relieve; while, at the same time, they may increase the danger of chronic inflammation. They should never be used as substitutes for the course of treatment above recommended, but only as adjuvants; for, if administered while the causes of the disease continue to act, they can only afford present relief at the risk of future mischief. When the stomach is placed under circumstances in which, upon being excited to the proper point by artificial means, it can execute its function duly without further aid, tonics may be advantageously employed; but they should be omitted as soon as they are found no longer necessary. The best for the purpose are, on the whole, the purer bitters, such as quassia, gentian, and columbo. Chamomile is well adapted to mild cases. Wild cherry bark may be used when an irritable circulation, indicated by the occurrence of palpitations or very frequent pulse under slight excitements, is associated with the gastric depression. Serpentaria is applicable to cases of unusual debility; and valerian may be advantageously combined with the bitters, when the patient is affected with symptoms of hysteria, or other nervous functional disorder. The officinal infusions of these medicines may be given in the dose of a wineglassful, three or four times daily. Gentian and quassia may also be conveniently administered, in the form of extract. The tinctures should be employed cautiously, and only as adjuvants of the other preparations, when the stomach is very feeble. Of the mineral tonics, the chalybeates are to be preferred. Of these, the best are the pills of carbonate of iron of the U. S. Pharmacopœia. Sulphate of iron combined with twice its weight of carbonate of soda or carbonate of potassa, and incorporated, either in liquid mixture or pill, with honey or syrup, affords a good substitute for this preparation, when it does not happen to be at hand. Subcarbonate of iron, tincture of chloride of iron, and solution of iodide of iron, are also good preparations. The chalybeate mineral waters, which usually contain the carbonate of iron dissolved by means of carbonic acid, are among the best tonics in dyspepsia. Besides the substances mentioned, sulphuric, nitric, muriatic, and nitromuriatic acids, subnitrate of bismuth, sulphate of zinc, and nitrate of silver, are sometimes used. I have found the nitromuriatic acid especially useful in cases in which the gastric symptoms were associated with a foul breath, indicating an impure state of the blood. Carbonic acid water is also an excellent tonic in dyspepsia, and usually very acceptable to the stomach, but like all others is liable to be abused. Creasote has also been recommended; but I have not employed it. A current of electricity or galvanism, made to pass through the stomach, is sometimes useful when that organ is peculiarly torpid.

Advantage will often accrue from the combination of medicines, to meet different indications. Thus, the bitter tonics may be associated with the aromatics, and, when a laxative effect is desired, with the cathartics. An infusion of columbo, ginger, and senna is an excellent preparation, from which I have derived great advantage in dyspepsia.* Rhubarb among the cathartics, and orange peel, cloves, cardamom, fennelseed, &c., among the aromatics, may in like manner be connected with the bitters; and, when there is excess of acid in the stomach, an alkaline carbonate may be added to the infusion. The extracts of gentian and of quassia may be combined, in pills, with rhubarb or aloes, and one of the chalybeates; and, when a carminative effect is desired, with an aromatic volatile oil. When the bilious secretion is deficient, a little of the mercurial pill or calomel may be added.

It is always proper to attend to the state of the skin. To invite excitement to the surface, and restore the function of perspiration, are prominent indications. The use of the cold or shower bath, of the warm salt-bath, and of frictions has been already mentioned. Flannel should be worn next the skin at all seasons, unless in the very hottest weather of summer, when they who perspire very freely may substitute some soft and warm fabric of cotton or silk. Occasional small doses of opium and ipecacuanha combined are recommended by Dr. Wilson Philip. The coldness of feet, so common in this complaint, should be obviated by stimulating applications, and suitable covering. The occasional use of mustard pediluvia, the wearing of socks sprinkled with Cayenne pepper, and the application of a plaster of Burgundy pitch, or of the resin plaster, to the soles of the feet, have all been recommended. Perhaps the most effectual method is to bathe the feet every morning, for a short time, in very cold water, and then rub them thoroughly dry. This, however, should not be practised, unless reaction take place readily.

The hepatic secretion demands a vigilant attention. If diminished or deranged, it is best corrected by alterative doses of mercurial pill or calomel, either alone, or combined with the tonic and purgative medicines. The decoction or extract of dandelion may be used as an adjuvant; and nitromuriatic acid may sometimes be advantageously substituted for the mercurial.

Various incidental affections, occurring in the course of dyspepsia, require a treatment more or less independent of the general plan. For an account of these the reader is referred to the different heads under *Irritation of the Stomach*, where he will find a detail of the treatment appropriate to *gastralgia*, *pyrosis*, *spasm of the stomach*, *nausea and vomiting*, and *sick-headache*, all of which are occasional attendants on this complaint. I shall have occasion hereafter to treat of *flatulence*. Some more precise remarks upon the remedies for *acid in the stomach*, than will be found in other parts of the work, may be appropriate here. The best palliatives for this are the antacids. Of these magnesia is the most effective as a neutralizing agent, and should be preferred when the quantity of acid is large, and there is a coincident indication for a cathartic effect. The carbonate of magnesia is less disagreeable to the taste, and may be substituted in twice the dose, when the carbonic acid which it evolves may not constitute an objection. Being in lump, it is habitually chewed by some persons, in minute quantities, when they suffer with heartburn. When the quantity of acid is small, the solution of magnesia in carbonic acid water, by which the bicarbonate is probably formed, may be used by those who prefer it. In cases which do not require a laxative, the bicarbonate of soda is preferable to the magnesian preparations, as more acceptable to the stomach. When vomiting is connected with acidity, lime-water is often given with advantage. (See *Vomiting*.) If diarrhœa exist, and a laxative effect is to be avoided, prepared chalk or prepared oystershell should be preferred. In cases of great stomachic torpor or coldness, the preparations of ammonia are most appropriate. The carbonate, aqueous solution, spirit, or aromatic spirit of ammonia, may either of them be given. The last is the most elegant, though rather feeble, and may be usefully added to the other antacids, which it renders less offensive to a very weak stomach. None of these antacids should be employed unless acid is actually present, as they have no power to prevent its generation. Their beneficial operation is chiefly confined to the removal of a present evil, and, if too largely given, most of them have a tendency to debilitate the stomach. A proper regulation of the diet, and the application of all the means above detailed as remedies for dyspepsia, must be looked to for permanent relief. Recently prepared charcoal, finely powdered, is sometimes useful by absorbing the acids, and other offensive liquids and solids in the alimentary canal. It may be given in the dose of a teaspoonful or more three or four times a day; but care should be taken not to allow it to accumulate in the bowels.

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* ℞.—Colomb. contus., Zingiber. contus., āā ℥ss; Sennæ ʒij; Aq. bullient. Oj. Fiat infusum. S. A wineglassful twice or three times daily, before meals.

When chronic gastritis has supervened upon dyspepsia, the patient must be treated for the former affection, reference being always had to the debility of stomach, and general debility which attend the latter.

SUBSECTION IV.

DISEASES OF THE BOWELS.

Article I.

INFLAMMATION OF THE BOWELS.

The intestinal tube is seldom if ever inflamed throughout its whole extent. Nor are the phenomena which different portions of it present, or the treatment they demand, in a state of inflammation, quite identical. It is, therefore, convenient to divide the intestines into distinct sections, and to consider the affection in each of these separately. It is, nevertheless, true that inflammation in any one section often spreads, to a greater or less extent, into that which adjoins it; and, in some instances, it would be impossible to decide which of the two is most prominently affected. I shall treat separately of inflammation of the upper portion or duodenum, of the middle portion, embracing chiefly the jejunum and ileum, and of the lower portion or large intestines.

1. INFLAMMATION OF THE DUODENUM, or DUODENITIS.

The duodenum is liable to the same modes of derangement as the stomach, and very frequently participates in its diseases. Thus, the various forms already described of gastric inflammation and irritation, cancer of the stomach, and even that condition of the organ denominated dyspepsia, extend in many instances to this portion of the bowels. Indeed, the duodenum itself is very seldom independently affected. The modifications produced either in the symptoms or treatment of stomachic disease by this complication are very few; and, even where the duodenum may be supposed to be the exclusive seat of disorder, the phenomena and indications of cure are so similar to those presented by the analogous condition of the stomach, that it would be useless repetition to enter into minute detail, in relation to the morbid affections of the former structure. I shall, therefore, content myself with referring merely to the diagnostic symptoms, and to those points in the treatment which are in any degree peculiar.

The circumstance, in diseases of the duodenum, which most deserves notice, is their peculiar tendency to produce functional disorder of the liver. Diseases exclusively gastric have the same tendency, but in an inferior degree. Broussais appears to have been the first to call attention decidedly to this fact. Among the phenomena of hepatic or bilious disorder, accompanying affections of the duodenum, the most striking is a jaundiced state of the skin. The mode in which this is produced has been variously explained. It has been ascribed to a closure of the common duct of the liver, either by mucus, or a thickening of its coats consequent upon duodenal inflammation, and to the absorption of the bile thus impeded in its passage to the bowels. This explanation may possibly apply to some cases; but it is probably not true in general, and certainly not universally; for cases of duodenitis with jaundice occur, in which bile freely enters the bowels; and, in fatal cases, the duct has been repeatedly found upon dissection entirely unobstructed. A more probable explanation is founded upon the observation of Bichat, that, between a secreting gland and the surface upon which its excretory duct opens, there is a sympathy by which a stimulus applied to the latter causes an increased action in the former. Thus, the stimulus of food in the mouth causes an increased secretion of saliva. In like manner, the presence of the chyme in the duodenum stimulates the liver and pancreas, so that an increased supply of bile and pancreatic fluid, which are useful in the process of digestion, may be received where they are wanted. Irritation or inflammation of the duodenum should, therefore, produce irritation of the liver, which, according to its degree, may be attended either with an increase or diminution of the secretion of bile. In the former case, absorption may take place from the abundance thrown into the biliary passages and bowels; in the latter, the materials out of which the bile is formed accumulate in the blood; and, in both cases, the yellow colouring matter is eliminated upon the surface and elsewhere. Again, in the dyspeptic or depressed state of the duodenum, it is incapable of receiving the ordinary impression from the chyme, and the ordinary stimulus is consequently not supplied to the hepatic secretory function. In this way also the secretion of bile is diminished, its materials accumulate in the blood, and jaundice results. But, notwithstanding the occasional dependence of bilious affections upon disease of the duodenum, I believe that some authors have pushed this view much too far, and given to that viscus a pathological importance which it does not merit. Jaundice and other bilious symptoms may sometimes result from duodenal inflammation; but much more frequently they proceed originally from the liver, and the duodenum, if at all involved, is so either secondarily or simultaneously, from its exposure to the influence of the same causes.

Diagnosis.—Duodenitis, when it occurs, is almost always associated with inflammation of the stomach or of the bowels. Its existence may be suspected when, in addition to the ordinary symptoms of gastritis, there is deep-seated pain in the vicinity of the pylorus, extending below the stomach toward the left hypochondrium, or pain in the back about the first or second lumbar vertebra; when there is tenderness upon strong pressure in the space which lies immediately to the left of the right hypochondrium, without any evidence of enlarged or inflamed liver; and when the skin is more or less yellow, and the urine bilious, as in jaundice. If these symptoms should occur, without vomiting, great thirst, or pain and tenderness in the region of the stomach, indicating gastritis; without diarrhœa, pain in the lower bowels, or tympanites indicating enteritis; and without enlargement or tenderness of the liver indicating hepatitis, it may be inferred that the inflammation is confined chiefly, if not exclusively, to the duodenum. In acute duodenitis there is occasionally, along with the fever, a degree of coma dependent probably upon the hepatic derangement. In the chronic form of the complaint, a diagnostic symptom is the occurrence of pain two or three hours after a meal, arising from the passage of a portion of the contents of the stomach into the duodenum. The bowels in duodenitis are generally slow, but readily acted on by cathartics.

The appearances after death are so similar to those in gastritis as not to require particular notice, except in relation to the mucous follicles, or, as they are often called, the glands of Brunner, which are very numerous in the duodenum, especially near the pylorus, and, in inflammation of this viscus, are apt to be enlarged, exhibiting sometimes elevated, irregular, almost continuous patches, of considerable extent.

The causes of duodenitis are essentially the same as those of inflammation of the stomach. Such of them, however, as act through the liver are probably more influential in producing the former than the latter affection.

Treatment.—The treatment also is that adapted to gastritis. If there is any difference, it is chiefly in the freer use of mild cathartic medicines, such as the neutral salts, bitartrate of potassa, castor oil, senna, &c., and in a more frequent employment of mercury, which in the acute form may be pushed to salivation, but in the chronic should in general be restricted to an alterative action on the functions of the liver.

2. INFLAMMATION OF THE SMALL INTESTINES, or ENTERITIS.

Syn.—Muco-enteritis.—Ileitis.—Ileo-colitis.

The name enteritis is, strictly speaking, applicable to inflammation of any portion of the bowels; yet, as this affection, in the upper and lower extremities of the intestinal tube, has received the designations of duodenitis and dysentery, and as the symptoms of these two complaints are in certain points strikingly peculiar, it becomes convenient to give a distinct name to inflammation of the intervening portion, and enteritis may perhaps, without impropriety, receive this more restricted meaning. It should be understood that inflammation of the peritoneal coat of the bowels, as a distinct affection, though hitherto frequently denominated enteritis, is not here included under that term, as it clearly belongs to peritonitis. Enteritis, then, as employed in this work, signifies inflammation of the mucous membrane of the jejunum and ileum, extending frequently to a greater or less distance into the colon, and occasionally involving the other coats as a secondary result. The force of the disease is usually spent upon the ileum; the jejunum being less liable to inflammation than any other portion of the alimentary canal. The greater liability of the ileum to be affected depends, probably, on that arrangement by which the fluids, in their passage through the bowels, are somewhat impeded at the ileo-cæcal valve, and commencement of the ascending colon, and thus have the opportunity of exercising a more protracted irritant influence on this than upon the upper portion of the tube. As the inflammation may extend indefinitely into the colon, it is obvious that the phenomena of dysentery must often be mingled with those of the complaint under consideration; and cases occur, in which it would be impossible to decide to which affection they should be referred; yet, for the most part, the symptoms are sufficiently distinctive. Attempts have been made to divide enteritis into the common diffused inflammation of the membrane, the follicular or that affecting especially the mucous follicles, and the pseudo-membranous or that attended with the formation of false membrane. But though there are cases in which each of these forms severally predominates, yet they are frequently intermingled; they offer no symptoms during life by which they can be sufficiently distinguished when occurring as original affections, and, even could they be distinguished, no great practical good would accrue. The peculiar intestinal affection of enteric fever is treated of in connexion with that disease.

Acute Enteritis.—The complaint commonly begins with uneasiness in the bowels, followed after a time by occasional slight griping pains, which gradually become more frequent and severe. In some cases, however, the symptoms are violent from the commencement, and in others, again, very little pain is felt throughout. There is generally more or less tenderness upon pressure. The seat of the pain and tenderness is usually about the umbilicus, though it varies with the part inflamed, and is not unfrequently found more especially in the right iliac region.

Diarrhœa is a very frequent symptom. Discharges from the bowels are apt to follow attacks of griping pain, which they often mitigate; and several of these discharges may occur in the course of a day. The lower in the bowels is the seat of inflammation, the more liable is it to be attended with diarrhœa, and the more frequent, as a general rule, are the evacuations. In cases where the bowels are not loose, they are for the most part readily and frequently moved by very small doses of mild cathartics. Sometimes the diarrhœa is suspended and again recurs, and this may happen several times during the course of the complaint The stools are usually liquid, consisting of the increased serous exhalation of the intestines, mixed with fecal matter, bile, mucus, and undigested food, and sometimes tinged with blood. Occasionally they are dark or green from the changed bile, or clay coloured from the absence of that fluid. There is occasionally some flatulent distension of the bowels; but this rarely amounts to tympanites, unless in children. When the inflammation depends upon obstruction in the bowels, or affects to any considerable extent the muscular and peritoneal coats, constipation instead of diarrhœa is experienced. Sometimes, indeed, the constipation, in inflammation involving the whole thickness of the bowel, is extremely obstinate, giving rise to vomiting and tympanitic distension, so as to resemble cases of obstruction, and sometimes to have been mistaken for them, with unfortunate therapeutical consequences.*

Febrile symptoms sometimes precede those of a local character, the sympathies and sensibility of the intestinal mucous membrane being such, that its inflammation may be felt by the system at large before making itself known by pain or increased secretion. In such cases, there is general uneasiness, languor, and diminished appetite, with alternate chilliness and flushes of heat for some days before the occurrence of pain. The fever when established is often remittent in character. The pulse is more or less excited and usually well developed, the skin dry, the urine scanty, and the tongue moist and somewhat furred. There is usually little or no headache or delirium.

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* See an interesting paper by P M. Kollock, M. D., of Savannah, Georgia, in the *Am. Journ. of Med. Sci.*, N. S., vii. 348.

The disease is often very mild, running its course in a few days, with little fever or pain, and but a slight diarrhœa. Even the severer cases, when properly treated, and not injuriously complicated, or subjected to the continued action of the cause, generally begin to decline in about a week. The result, however, is not always so favourable. The pains instead of diminishing, are aggravated; the flatulent distension increases; the discharges become very offensive; inflammation ascends to the stomach, and vomiting occurs, with burning thirst, and epigastric tenderness; the liver sometimes becomes involved, and jaundice is added to the other symptoms; delirium sets in; the tongue becomes red and dry, and the pulse frequent and feeble; great emaciation takes place; and the patient either sinks at last, or recovers after a tedious and uncertain convalescence. In other cases, the peritoneal coat becomes inflamed, in consequence either of a direct extension of the disease from the mucous coat, or of an ulcerative perforation of the intestine, and the escape of its contents into the abdominal cavity. This event is marked by the occurrence of symptoms characteristic of peritonitis, and is very generally the forerunner of a fatal issue. Acute enteritis also frequently terminates in the chronic form.

Typhlitis.—Some writers make a distinct disease of inflammation of the *cæcum* and its appendages, under the name of *typhlitis* (τυφλον, cæcum), or *perityphlitis*, when it extends to the neighbouring cellular tissue. Pain and tenderness in the right iliac region, attended sometimes with obstinate constipation, and even the symptoms of obstruction, sometimes with a muco-feculent diarrhœa, and occasionally with an aching sensation in the lumbar region, are the characteristic phenomena. Not unfrequently a tumefaction, with more or less hardness, can be perceived upon external examination, which may be well defined when confined to the intestine alone, but is somewhat diffused when there is conjoined inflammation of the external areolar tissue. In the former case, the tumour will generally yield a dull sound on percussion, indicating that the cæcum is filled with solid matter. The cause is most frequently accumulation of feculent matter, undigested food, or insoluble bodies taken into the stomach, as the stones of fruit, &c. Like other portions of the bowels, the cæcum is liable to ulcerative perforation, which may occasion diffused or circumscribed peritonitis, or, if the perforation be in the posterior part of the bowel, where it is attached without peritoneal covering to the iliac fascia, may occasion the formation of abscesses, opening after a longer or shorter period of suffering, hectic, &c., in the lumbar region. The *appendicula vermiformis* is also, in some instances, the seat of inflammation which may end in ulceration, perforation, and peritonitis. This is especially apt to result from the presence of insoluble bodies, such as calculous concretions, and the stones or seeds of fruits. Sometimes the inflammation in the cellular tissue around the bowel ends in suppuration and the formation of an abscess, which opens externally, without any reason to suppose that the bowel had been perforated.

Anatomical Characters.—The same changes of colour, consistence, and thickness in the mucous membrane are found in this disease as in gastritis. (See *Acute Gastritis.*) The follicles, however, are more frequently seen enlarged, forming small eminences, sometimes ulcerated upon their summits, and surrounded by an areola of inflammation. Occasionally two or more of these ulcers coalesce, presenting a more extended surface, and an irregular outline. Ulceration is also observed in intervening portions of the membrane. The process sometimes extends deeply into the parietes of the bowel, penetrating the submucous and the muscular tissues, and leaving only the peritoneal coat at the bottom of the ulcer. Under such circumstances, a moderate force is sufficient to produce a rupture, and consequent effusion into the abdominal cavity. This, however, very seldom happens, unless in typhoid fever or tuberculous affections. Portions of false membrane are occasionally, though rarely, observed adhering to the surface of the mucous membrane. Gangrenous sloughs are rare, probably because death ensues before those changes can occur which are consequent upon mortification. In some instances, however, portions of the bowels have been found dark and gangrenous, especially in cases of obstruction; and, in such cases, the whole thickness of the intestine sometimes sloughs, allowing the escape of its contents.

Causes.—Among the causes of enteritis may be mentioned exposure to cold, especially when in a state of perspiration, retrocession of gout, rheumatism, and cutaneous eruptions, and the suppression of accustomed discharges. It is produced, also, by the direct contact of irritating substances, as by articles of food which have passed undigested through the stomach, acrid medicines, especially drastic purges, poisons, hard insoluble bodies which have been swallowed, acrid secretions from the stomach, liver, pancreas, and bowels themselves, worms, and by various causes which more or less completely obstruct the bowels, such as feculent or other solid accumulations, tumours, intussusceptio, strangulation, &c. Enteritis is a frequent attendant upon other diseases, especially typhoid fever, the exanthemata, and consumption, is one of the consequences of extensive burns, and may arise from the propagation downward of inflammation of the stomach. It attacks indiscriminately persons of both sexes and all ages, but is probably most common in children.

Diagnosis.—This complaint is distinguished from peritonitis by the want of that intense pain and tenderness, that excessive vomiting, that obstinate constipation and tympanites, and that contracted, frequent pulse, so common in the latter affection. When these symptoms occur during the progress of enteritis, there is reason to believe that the inflammation has attacked the peritoneal coat, and, if they come on suddenly, that the bowel has been perforated. Colic is distinguished by the greater severity of the pain and its more decided spasmodic character, by the relief afforded by pressure, by the constipation which attends it, and by the frequent entire absence of fever. Another affection with which enteritis might be confounded is rheumatism of the abdominal parietes. But in this the pain and tenderness are more superficial, the patient suffers extremely from any attempt to move his body, there is no diarrhœa, and, if any febrile action exist, it is much less than would attend an equal amount of local suffering from enteritis.

General Treatment.—Bleeding from the arm may be resorted to when the pulse is strong and excited, and may sometimes be repeated once and again with advantage in vigorous constitutions; but, in the great majority of cases, it should be moderately employed, and, in many of a mild character, or in feeble constitutions, should be wholly dispensed with. If the disease is attended with constipation, and especially if there is reason to believe that the liver is somewhat torpid, a cathartic dose of calomel should be given, followed, if it do not operate, by castor oil. Even when there is diarrhœa, laxatives are indicated in order to remove irritating secretions or accumulations. For this purpose castor oil often answers admirably well, combined with fifteen or twenty drops of laudanum, which relieves pain without preventing the action of the medicine. Magnesia is preferable when there is much acid in the bowels, which may often be known by the odour and colour of the stools. A mixture of magnesia and manna with fennelseed tea forms a very good combination, in such cases. Throughout the complaint, the bowels should be kept open, if necessary, by these laxatives, or by the neutral salts, so that there may be two or three stools daily. Emollient enemata may be substituted, if cathartics are found too irritating, and, in any case, may be used as adjuvants. The drastic purgatives should never be employed; and much smaller doses of the medicines mentioned will answer than under ordinary circumstances. It is also desirable to direct action towards the surface. When the skin is hot and dry, and the febrile action considerable, the neutral mixture or effervescing draught may be employed, combined, if it irritate the bowels, with a small portion of laudanum; in other cases, the powder of opium and ipecacuanha is preferable. This should be given at night, so as to procure rest. Calomel or the blue mass should be added, in small doses, when there is deficiency or derangement of the hepatic function. The warm bath is also very useful, especially in the cases of children. Should the disease not yield, one of the mercurials may be given in connexion with opium and ipecacuanha, in small doses, repeated at short intervals, and continued until the mouth is slightly affected.[*] Either of the mercurials already mentioned will answer; but, when there is considerable diarrhœa, the blue mass, or mercury with chalk, is perhaps preferable to calomel. In the advanced stages, after the subsidence of fever, and when the indication to check diarrhœa exists, cretaceous or testaceous mixtures, containing the blue mass and laudanum, and given in small and frequently repeated doses, will be found highly useful, particularly in children.[†] Under similar circumstances, I have also derived advantage from a mixture of nitro-muriatic acid and laudanum.[‡] Great care is requisite in relation to the diet. In very severe cases, with much fever, a solution of gum arabic will be sufficient. When something more nutritious is required, the farinaceous drinks, such as barley-water, rice-water, bread-water, and solutions of arrowroot, sago, and tapioca may be given. A little black tea and dry or toasted bread may be allowed to patients who crave them. In the declining stages, weak chicken or mutton broth, without fat or vegetables, will sometimes be found useful.

Local Treatment.—The most efficient local measure is leeching immediately over the seat of tenderness. Three or four dozen American leeches will generally be sufficient, though more may often be applied with advantage. When these cannot be obtained, cups may be substituted. Many cases, however, require neither. Warm fomentations or emollient cataplasms should be kept constantly applied for days together; with these laudanum or hops may be conjoined as anodynes; and advantage will sometimes ensue from the addition of a little mustard, or other rubefacient. I have found much benefit from bruised garlic mixed with emollient cataplasms, especially in infantile cases with tympanitic abdomen. When the disease is obstinate, a blister should be applied over the abdomen, and, if a mercurial impression is desired, the vesicated surface may be dressed with mercurial ointment.

When the stomach, liver, or brain, becomes involved, treatment adapted to the affections of these organs respectively must be resorted to. Should the disease reach the peritoneal coat, more active depletion, both general and local, will be required. But if the peritoneal inflammation arise from perforation of the bowel, and the escape of its contents, large and frequent doses of opium, as recommended by Graves and Stokes, are the only means from which much good can be expected. (See *Peritonitis.*) In convalescence, it is highly important to regulate the diet so as to avoid relapses, which probably proceed from errors in this respect more commonly than from any other cause. The patient should resist his frequently strong inclination to eat to excess. The lightest and most digestible articles of animal food should first be employed, along with easily digestible farinaceous substances, and a gradual advance made to more substantial aliment. Most of the fresh vegetables and fruits should be avoided until health is re-established.

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[*] ℞.—Opii pulv., Ipecac. pulv., āā gr. ij; Pil. Hydrarg. gr. xij; Acaciæ pulv., Syrup, āā q. s. Misce et fiant pil. no. xij. S. One every two hours.

[†] ℞.—Cretæ Ppt., vel Testæ Ppt. ʒij; Pil. Hydrarg. gr. viij; Tinct. Opii gtt. xxx; Acaciæ pulv., Sacch., āā ʒiss; Aquæ Cinnam. f℥j; Aq. fluvial. f℥iij. Misce. S. A tablespoonful for an adult every two, three, or four hours; to be diminished for children.

[‡] ℞.—Acid Nitromuriatic. gtt. xl; Tinct. Opii gtt. xl; Aquæ fluv. f℥viij. Misce. S. A fluidounce to be taken six times a day, diluted with water, in a glass vessel.

Occasionally, after the complete disappearance of all evidences of inflammation, a diarrhœa is left, dependent probably upon a relaxation of the secretory vessels or orifices, consequent on the previous excitement. In such cases, tonics and astringents become useful. (See *Diarrhœa.*)

Chronic Enteritis.—This may follow the acute disease, or may be the direct result of the same causes, operating with less force, or upon a less susceptibility. Diarrhœa is even more characteristic of chronic than of acute enteritis. Most cases of very obstinate diarrhœa are, in fact, nothing more than chronic inflammation of the bowels. The frequency, quantity, and quality of the stools vary exceedingly. Sometimes the number does not exceed two or three in twenty-four hours, sometimes the patient enjoys no rest from their recurrence; and this diversity is often found at different periods of the same case. The amount discharged is in some instances trifling, in others exceedingly abundant. In character, the evacuations are not unlike those of acute enteritis. Occasionally portions of false membrane are discharged, and, in some rare instances, tubes of considerable length, obviously the result of a plastic inflammation, throwing out coagulable lymph upon the surface of the mucous membrane. Such cases are apt to be somewhat tedious, but may nevertheless do well in the end.* In the advanced stages of the complaint, the evacuations are sometimes mingled with pus, which is an unfavourable

* A variety of chronic pseudomembranous inflammation of the bowels has been described by Dr. W. Cumming, of Edinburgh, having peculiar characters, and demanding a peculiar treatment. When in Edinburgh, in the summer of 1848, I had my attention called by Professor Simpson to a peculiar intestinal affection which he said was not uncommon in that city, and in which, considering it to be a kind of eruptive disease of the bowels, he was using the arsenical solution as a remedy. I presume that it was the same complaint as that described by Dr. Cumming. The characteristic symptoms, according to this author, are a feeling of emptiness or faintness at the epigastrium; a more or less fixed pain in the left hypochondriac or iliac region, or both; an appetite and digestion not materially impaired, but pain in the route of the colon an hour or two after eating; the bowels sometimes loose, sometimes constipated; and the discharge of a peculiar fibrinous matter, which is in some instance stringy or tape-like, in others in small masses, and in others again diffluent or gelatinous. The appearance of this fibrinous matter in the stools is the pathognomonic symptom. There is, besides, great nervous disorder, producing sleeplessness, unpleasant dreams, mental depression or hallucination, &c. The remedy which, after the failure of all ordinary measures, has been found successful in these cases by Dr. Cumming, is electro-galvanism, which he believes competent of itself to the cure of almost every case, and, aided by the internal use of tar, which was suggested by Dr. Simpson, will cure the disease both certainly and promptly. Dr. Cumming used the instrument of Kemp, of Edinburgh, which supplies a continuous stream of any required intensity without a "jerk or shock." He connects pieces of sponge to the extremities of the two conducting wires, applies one to the spine in the lumbar region, and carries the other from point to point on the abdomen over the track of the colon. One of the peculiarities of its action is to develope pain, or extreme tenderness, in the affected parts of the bowel. It has the effect of keeping the bowels duly open. The remedy should be applied for fifteen minutes daily, and used perseveringly. The tar is to be given in pill or capsule three times a day. (*Medical Gazette*, Decemb. 1849, p. 969.)

sign. There is generally more or less pain; and strong pressure, or any sudden jar, as in coughing or jumping, occasions uneasiness. Sometimes the pain is severe, and, though relieved after each evacuation, returns so frequently as to keep the patient in almost constant distress. In many cases, it comes on at a certain period after eating, indicating the time at which the ingesta reach the spot affected. The abdomen is sometimes very flat, sometimes much distended, and even tympanitic. The appetite is often craving, and seldom wholly wanting, unless when the stomach participates in the disease. Occasionally, the system scarcely evinces any other signs of sensibility to the local affection than a diminution of strength, and a more or less rapid emaciation. Generally, however, the pulse is somewhat increased in frequency, the tongue slightly furred, and the skin dry and harsh. In bad and protracted cases, the tongue is sometimes red, smooth, and dry, or aphthous, and the pulse very frequent. The spirits are usually depressed, sometimes greatly so, the patient being gloomy, morose, or irritable, dwelling on nothing but his own suffering, and seeing no hope before him. The mental disturbance amounts, in some instances, to insanity, which may be very obstinate. The stomach not unfrequently participates in the inflammation, and then all the symptoms of chronic gastritis are superadded. The duration of the disease is exceedingly variable. It may be cured within a week or two from the commencement of treatment, or may run on for years. When of long duration, it generally undergoes numerous vicissitudes; the patient being at one time much relieved or nearly well, and then again relapsing, upon some new exposure, or even without obvious cause. Towards the close of fatal cases, hectic fever usually takes place, and the patient becomes much emaciated.

Besides the usual marks of inflammation in the mucous membrane, the surface, upon dissection, often appears strewed over with enlarged or ulcerated follicles. Ulcers are even more common in this than in the acute form of the disease. The mesenteric glands are sometimes found enlarged, and even suppurating.

The causes are the same as those of acute enteritis. A tuberculous diathesis strongly predisposes to the complaint; and, in very obstinate cases, which cannot be traced to cancerous disease of the bowels, or other obvious cause, there is great reason to apprehend that tubercles may have been developed in the mucous membrane. Chronic enteritis is a very common attendant upon the advanced stages of phthisis.

Treatment —One of the most important parts of the treatment is the regulation of the diet. As the appetite is often unimpaired, and sometimes craving, the patient is constantly tempted to transgress, both in the quantity and quality of his food; and this is one of the chief causes of the occasional obstinacy of the complaint. The dietetic rules applicable here are so nearly the same with those already given under chronic gastritis, that it is unnecessary to repeat them. The particular kind of food which, on the whole, is most suitable, is milk; and patients will frequently get well without medicine, if confined to that article exclusively. But, as it would thus be very irksome, it may be taken with stale bread or water-crackers, or boiled and thickened with wheat or rice flour, arrowroot, carrageen moss, &c. A decoction of Iceland moss with milk is sometimes useful, as well by its tonic as its nutritive properties. When the debility is considerable, it is necessary to have recourse to animal broths, &c. (See *Chronic Gastritis.*)

General bleeding is seldom admissible in chronic enteritis; but occasional leeching may be resorted to with great advantage. Laxatives are required only when the bowels are slow, as sometimes though rarely happens, or when an accession of irritation arises from acrid accumulations. Opiates are almost always indicated. They prove useful by relieving pain, moderating secretion, and quieting that excessive action of the bowels which is itself injurious to the complaint. Opium may be used in the manner recommended for acute enteritis, or in small doses combined with the various remedies which may be given to meet other indications. I have found the camphorated tincture of opium an excellent preparation in this complaint. A fluidrachm of it given three or four times a day, is, in many cases, the only medicine which will be required, in connexion with a properly regulated diet. Acid in the bowels may be corrected by cretaceous preparations, as in the acute form. The astringents, as kino, catechu, rhatany, logwood, alum, acetate of lead, &c., sometimes answer a good purpose, when the inflammation is very moderate, and its consequences, rather than the affection itself, are to be combatted. (See *Diarrhœa.*) They should be combined with an opiate, and often form a good addition to cretaceous mixtures. But not unfrequently they either fail to arrest the discharge, or, by arresting it, aggravate the inflammation, producing an increase of pain, abdominal distension, fever, &c. When such results occur, the astringents should be immediately omitted; and, on the whole, they should be used with much caution. There is, however, a set of mineral substances, which, independently of their astringent properties, exercise an alterative influence over inflamed and ulcerative surfaces, which renders them highly useful in some cases. Of these sulphate of copper is one of the best. In the dose of one-sixth or one-quarter of a grain, combined with from a sixth to a twelfth of a grain of opium, and given every three or four hours through the day, I have seen it do great apparent good in obstinate cases of chronic enteritis. To be effectual, it must be continued for a considerable time. The nitrate and oxide of silver with opium have also been highly recommended, and the sulphate of zinc may be similarly employed. Oil of turpentine and copaiba sometimes prove useful through their alterative influence over the mucous membranes. I have found the oil especially useful in those cases in which the tongue is destitute of fur, smooth, and perfectly dry. They should be given in emulsion, and, like the other remedies, combined with an opiate. Tar-water is also sometimes useful. In some feeble cases, the simple bitters, sulphate of quinia, and the chalybeates are serviceable by imparting a degree of tone to the ulcerated and relaxed mucous surface, which is necessary to the curative process.

In conjunction with the above measures, the warm or hot bath is highly important; the former being preferred when the temperature of the skin is above, the latter when it is at or below the healthy standard. In the latter case, the warm salt-bath is an admirable remedy. It should be given daily, and may sometimes be advantageously repeated twice a day. Frictions to the surface are also useful. When the symptoms are somewhat acute, a large blister may be usefully applied over the whole abdomen; and a small blister near the affected part, frequently repeated, or kept open by stimulant dressings, will often be found beneficial in ordinary cases. Pustulation with tartar emetic or croton oil may be tried, when the complaint is obstinate. The patient should always wear flannel next the skin; and a broad flannel roller passed frequently round the abdomen is sometimes of service.

Should other means fail, recourse should be had to a mercurial impression, which should not be carried beyond a very slight effect upon the gums, and should be sustained for a considerable time. Obstinate cases often yield speedily to this remedy. In cases attended with the discharge of false membrane in considerable quantity, an alterative course of mercury should be immediately instituted.

Moderate passive exercise, mental recreation, relaxation from business, sea-bathing, a journey into the country, a sea-voyage, and a residence abroad may be resorted to, as recommended in chronic gastritis, when the condition of the disease, or the circumstances of the patient, do not forbid them.

3. DYSENTERY.

Syn.—Inflammation of the large Intestines.—Colitis.—Colo-rectitis.—Bloody Flux.

Dysentery is inflammation of the mucous membrane of the colon and rectum, characterized by small mucous or bloody evacuations, griping pains in the abdomen, straining at stool, and tenesmus. Inflammation in the colon, without these phenomena, would rank under enteritis. Dysentery may be acute or chronic.

1. **Acute Dysentery.**—The disease may occur with or without premonitory symptoms. In the former case, it is preceded by general uneasiness, lassitude, impaired appetite, dull or transient pains in the abdomen, costiveness or diarrhœa, and other evidences of moderate intestinal irritation. Sometimes the local symptoms make their appearance before those of a general character; and, in very mild cases, of moderate extent, the disease may run its course without fever. Sometimes the local and febrile phenomena commence simultaneously, the patient being attacked with a chill almost at the moment that he begins to complain of pain and tenesmus. Again, the fever often precedes, and occasionally for a considerable period, any evidence of disorder in the bowels. In such cases, however, the dysentery is usually a mere attendant upon some other disease.

We are presented, in different cases of dysentery, with a regular gradation in severity, from a very slight affection, occupying but a small extent of the rectum and colon, unattended with fever, and passing off in two or three days, up to one of the most violent and dangerous forms of disease to which the human frame is liable. This diversity is dependent partly on differences in the activity of the cause, and the susceptibility of the patient; but it is important to recollect, that it may also depend upon the degree in which the disease is simple or complicated. Generally speaking, mere mucous inflammation of the large intestines is a mild affection; but it is very frequently associated, at the outset, with disease in some other organ or organs, or with some morbid state of the system at large, which, in various degrees, complicates the symptoms, and increases the danger. I shall first describe simple dysentery, and then allude to its more frequent combinations.

In the beginning of a case of *simple dysentery*, there are usually griping pains in the abdomen, technically called *tormina*, irregular in their position and periods of recurrence, and attended with discharges from the bowels, by which they are partially relieved. After a very short time, a sense of weight, burning, or other uneasiness is experienced in the rectum, with a painful and frequently returning inclination to go to stool, without the ability to evacuate anything more than a little bloody mucus. This feeling of *tenesmus* increases, and at length becomes the most striking feature of the case; the abdominal pains appearing to concentrate themselves in some measure about the rectum. The calls to stool are very frequent, in some cases almost incessant; are attended with much straining, so much so as sometimes to produce *prolapsus ani*, especially in children; and are followed by only partial relief. The discharges often occasion a burning or cutting pain in the anus, which leads the patient to dread their return, and to resist the disposition as long as possible. The passages are seldom less than a dozen in twenty-four hours, are often double or triple that number, and sometimes, in very bad cases, have been known to amount to one hundred and even two hundred. After the first few evacuations, which are often more or less fecal, the stools are very small, and consist of transparent or whitish mucus, or of mucus mixed with blood, and sometimes of almost pure blood. With these, as the complaint advances, a little vitiated bile, and shreds or patches of false membrane, or small masses of coagulated matter, are occasionally intermingled; and, in some instances, small hardened lumps of feces called *scybala* are discharged, though these are less common than might be inferred from many published accounts of dysentery. Feculent evacuations are almost always followed by considerable relief. At first the discharges have little smell; but after a time they acquire a disagreeable odour, almost peculiar to dysentery, and quite distinct from the feculent. The bladder and urethra sometimes sympathize with the rectum, and along with the tenesmus there is frequent and difficult micturition. In females, the vagina may participate in the same irritation. There is generally more or less tenderness in the abdomen; and the extent of the inflammation upwards, along the colon, can sometimes be traced by ascertaining in what parts pain is produced on pressure. When the tenderness is observed across the epigastrium, and along the right side, there is reason to believe that the inflammation has reached the transverse and ascending colon, and that the whole of the large intestines are involved.

There is always fever, except in cases of very small extent. The pulse is accelerated, and usually somewhat full and forcible, the skin warm and dry, the urine scanty, the tongue moist and covered with a whitish fur. The secretion of bile is generally diminished. Occasionally, in cases of some severity, the vital forces sink temporarily under the violence of the impression made on the nervous system. The patient experiences an indescribably painful feeling of hollowness or sinking in the abdomen, attended with a cold damp skin, a feeble and almost threadlike pulse, and sometimes nausea and vomiting. This condition, however, soon passes over, as the acrid secretions descend. In the simple form of the disease above described, vomiting is not frequent; and the symptoms of cerebral affection are still less so.

In the vast majority of cases, the disease takes a favourable turn between the sixth and tenth days, and the patient recovers. Sometimes, however, from the extent and severity of the inflammation, symptoms of depression appear at the outset, and the system never fairly reacts. Here the same condition appears to exist continuously, which has been above described as occurring occasionally in milder cases. The nervous system yields to the violence of the first shock, and is unable to react under the continued violence of the disease. The patient has, throughout, a very small, feeble, and frequent pulse, a pale, cool, and clammy skin, anxious and sunken features, and a somewhat livid or purplish appearance under the eyes, about the lips, and at the roots of the nails; while, at the same time, there is extraordinary violence in the local symptoms, with much tormina and tenesmus, incessant discharges, tense and tumid abdomen, and great tenderness on pressure. Such cases prove fatal in a few days. They are happily very rare, and I have seen them only during epidemics.

Danger much more commonly accrues from a continuance of the disease, in ordinary cases, beyond a week or ten days. Should the symptoms not give way by that time, they are all apt to become aggravated. The tormina and tenesmus increase; the abdomen becomes swollen and more tender; the discharges, more frequent; the pulse, weaker and more rapid; the tongue assumes a dryish and brownish appearance, or throws off its fur and becomes red, smooth, and sometimes gashed; the patient is weak, exhausted, and very restless; the stools are more copious and offensive, and, instead of consisting bathing, a journey into the country, a sea-voyage, and a residence abroad may be resorted to, as recommended in chronic gastritis, when the condition of the disease, or the circumstances of the patient, do not forbid them.

3. DYSENTERY.

Syn.—Inflammation of the large Intestines.—Colitis.—Colo-rectitis.—Bloody Flux.

Dysentery is inflammation of the mucous membrane of the colon and rectum, characterized by small mucous or bloody evacuations, griping pains in the abdomen, straining at stool, and tenesmus. Inflammation in the colon, without these phenomena, would rank under enteritis. Dysentery may be acute or chronic.

1. **Acute Dysentery.**—The disease may occur with or without premonitory symptoms. In the former case, it is preceded by general uneasiness, lassitude, impaired appetite, dull or transient pains in the abdomen, costiveness or diarrhœa, and other evidences of moderate intestinal irritation. Sometimes the local symptoms make their appearance before those of a general character; and, in very mild cases, of moderate extent, the disease may run its course without fever. Sometimes the local and febrile phenomena commence simultaneously, the patient being attacked with a chill almost at the moment that he begins to complain of pain and tenesmus. Again, the fever often precedes, and occasionally for a considerable period, any evidence of disorder in the bowels. In such cases, however, the dysentery is usually a mere attendant upon some other disease.

We are presented, in different cases of dysentery, with a regular gradation in severity, from a very slight affection, occupying but a small extent of the rectum and colon, unattended with fever, and passing off in two or three days, up to one of the most violent and dangerous forms of disease to which the human frame is liable. This diversity is dependent partly on differences in the activity of the cause, and the susceptibility of the patient; but it is important to recollect, that it may also depend upon the degree in which the disease is simple or complicated. Generally speaking, mere mucous inflammation of the large intestines is a mild affection; but it is very frequently associated, at the outset, with disease in some other organ or organs, or with some morbid state of the system at large, which, in various degrees, complicates the symptoms, and increases the danger. I shall first describe simple dysentery, and then allude to its more frequent combinations.

In the beginning of a case of *simple dysentery*, there are usually griping pains in the abdomen, technically called *tormina*, irregular in their position and periods of recurrence, and attended with discharges from the bowels, by which they are partially relieved. After a very short time, a sense of weight, burning, or other uneasiness is experienced in the rectum, with a painful and frequently returning inclination to go to stool, without the ability to evacuate anything more than a little bloody mucus. This feeling of *tenesmus* increases, and at length becomes the most striking feature of the case; the abdominal pains appearing to concentrate themselves in some measure about the rectum. The calls to stool are very frequent, in some cases almost incessant; are attended with much straining, so much so as sometimes to produce *prolapsus ani*, especially in children; and are followed by only partial relief. The discharges often occasion a burning or cutting pain in the anus, which leads the patient to dread their return, and to resist the disposition as long as possible. The passages are seldom less than a dozen in twenty-four hours, are often double or triple that number, and sometimes, in very bad cases, have been fever, preceded by chill, has existed for one, two, or three days before the dysentery begins, there can be little doubt as to the nature of the case. Greater difficulty is presented when the two occur simultaneously, or when the fever is the last to make its appearance. Generally speaking, however, such cases may be distinguished from uncomplicated dysentery, by their paroxysmal tendency. The fever is aggravated at a certain time every day or every other day, and in the interval either relaxes or entirely intermits; the dysenteric symptoms undergoing, to a certain extent, the same change. There is, moreover, during the paroxysm, more flushing of the face, pain in the head, tendency to delirium, general arterial excitement, and nervous disorder, than usually attend an attack of pure colitis; and the appearance of perspiration at the subsidence of each paroxysm is an almost certain diagnostic symptom. I have known dysentery to be intermittent, occurring paroxysmally and violently every other day, with very little disease of any kind in the intervening day. A correct diagnosis in these cases is important, because essential to the proper course of treatment.

Typhous Dysentery.—Dysentery is also sometimes associated with proper typhus fever. I have already treated of that form of the disease, in which symptoms resembling those of typhus attend it, in consequence of a previous or coexisting adynamic state of system. In that case, however, the fever is the result of the colitis, and the peculiar phenomena flow from the diminished energy of the solids, or the vitiated state of the liquids. But I now allude to the coincidence of dysentery with a distinct febrile disease, the result probably of a peculiar poison, which exists altogether independently of the bowel affection associated with it. Such cases occur during the prevalence of typhous epidemics. It is not so important, in a therapeutical point of view, to make an accurate diagnosis here as in the former variety; because the practice must be regulated by the obvious condition of the system. But these cases are interesting in reference to the question of the propagation of dysentery by contagion.

Authors speak also of *rheumatic dysentery;* but this is not distinguishable from the disease arising from ordinary causes, except sometimes in the mode of its attack, when the irritation is suddenly translated from some other seat to the large intestines. Besides the complications which have been mentioned, colitis may coexist with gastritis, enteritis, enteric fever, and various other diseases, local or general; in which case, the symptoms will of course be modified by combination with those of the associated affection.

Epidemic dysentery is frequently spoken of as if it were a peculiar form of the disease. But this is not the case. Every variety of the affection above referred to may occur epidemically, according to the peculiar influences which may be conjoined with the special cause of the colitis. Thus the disease may be quite uncomplicated; or it may be associated with results of miasmatic influence, as frequently happens in our own country; or it may exhibit the conjoined action of the typhous poison, as in the epidemics of Ireland. There is, however, in general one important characteristic of epidemics of dysentery; namely, that they are apt to be attended with evidences of malignancy, and that, on the whole, the disease is much more violent than when it occurs sporadically, or as the result of ordinary causes.

Prognosis.—When dysentery is about to terminate favourably, the pains gradually become less frequent and severe, the tenesmus diminishes, the stools become more copious and less frequent, and assume a fecal or bilious character, and at length nothing but a slight diarrhœa remains, which soon ceases. On the contrary, a sudden cessation of the tormina and tenesmus, the occurrence of tympanites, coldness of the extremities, or a cool clammy state of the skin chiefly or exclusively of mucus or blood, are mixed with puruloid matter, sanies, or vitiated secretions from the upper bowels, and are sometimes nothing more than a kind of bloody serum (*lotura carnium*). Even after the worst of these symptoms, however, the patient may recover, though the convalescence is usually tedious, and the case not unfrequently runs on into the chronic form. Should the event prove unfavourable, a set of symptoms usually supervene, which will be mentioned under the head of prognosis.

Bilious Dysentery.—In almost all cases of dysentery the bilious secretion is somewhat diminished; but, in the simple form of the disease, this may be considered as nothing more than a result of the colitis, in like manner as the dry skin and scanty urine. But occasionally disorder of the liver and stomach attends the disease from the beginning, being the result of causes either identical or coexistent with those which produce the intestinal affection. The complaint, under these circumstances, is sometimes called *bilious dysentery.* It is characterized by a feeling of oppression in the epigastric region; more frequent vomiting; occasional yellowness, in various degrees, of the tongue, conjunctiva, skin, and urine; a higher degree of fever; a greater tendency to delirium; and either an entire absence, morbid increase, or depraved condition of the biliary secretion. It is this complication which adds so much to the violence and danger of dysentery, occurring in tropical climates.

Adynamic Dysentery.—Another form of the disease is that which occurs in individuals previously exposed to the action of various depressing causes, as in ships, prisons, besieged towns, camps, and marching armies, in which exposure to wet and cold, unwholesome or insufficient food, fatigue, and wretchedness of every kind, combine with a contaminated atmosphere to prostrate the vital powers, and vitiate the blood. The same influence is sometimes exerted by certain epidemic constitutions of the air. Under these circumstances, along with the symptoms of ordinary dysentery in an aggravated degree, are those of malignant, typhoid, or scorbutic disease; such as nausea and vomiting; great thirst; a frequent, feeble, irregular pulse; a foul, brown or black, dry tongue, with sordes about the teeth; a dusky skin, sometimes hot, sometimes cold, and occasionally marked with petechiæ, dark livid spots, gangrenous vesications, &c.; reddish, brown, or black stools, more copious than in the simple disease, and excessively fetid, or large hemorrhagic discharges, consisting often of altered uncoagulable blood; great prostration of strength even from the beginning; and, finally, various evidences of nervous disorder, as anxiety, depression of spirits, headache, low delirium, subsultus tendinum, and stupor. All these symptoms are not found in every case, but are variously mingled, and in various degrees; sufficient generally existing to indicate pretty clearly the character of the affection. In the worst cases, the patient appears to be struck with death from the very beginning, and the disease proves fatal in a few days. In all cases, the danger arising from the mere colitis is very much increased by the complication. When the causes producing this form of dysentery unite with those which produce the bilious variety, we have occasionally a combination of symptoms unsurpassed in malignancy by those of any other disease.

Intermittent and Remittent Dysentery.—Dysentery is not unfrequently associated with other diseases. It is very common in miasmatic countries, and during the prevalence of epidemic intermittent and remittent fevers, sometimes apparently occurring as a distinct disease more or less modified by the prevailing atmospheric influence, sometimes in connexion with the proper miasmatic fever. In the latter case, the colitis may come on as a mere accessory of the fever, after it has continued a greater or less length of time, or it may first occur, and the miasmatic fever afterwards set in. When a decided much heated during the day. The perspiration is checked, and excitement thus directed inward; while the hepatic secretion is at the same time arrested, and congestion of the portal circle, and consequently of the mucous membrane of the bowels results. Substances directly irritant in their action on the bowels are often exciting causes. Among these may be mentioned unripe and acid fruits, ripe fruits in large quantities, vegetables of difficult solution in the stomach, and unwholesome and indigestible food of all kinds; acid and imperfectly fermented alcoholic drinks, such as cider, weak wines, malt liquors, &c.; putrid water; drastic purges; worms; and feculent and other accumulations in the large intestines. Formerly much importance was attached to collections of hardened feces as the cause of dysentery, and undoubtedly they occasionally produce or aggravate the complaint; but they are much less influential than was supposed. Exhalations from putrid animal substances, and vegetable miasmata are also among the causes.

Dysentery is not unfrequently epidemic, prevailing in some instances over considerable extents of country, but more commonly confined within small, and sometimes very accurately defined limits. In the latter mode, it often occurs in different parts of the United States. It is especially apt to prevail in miasmatic districts, preceding or accompanying intermittent and remittent fevers; but sometimes it cannot be traced to any local cause whatever. It is a frequent accompaniment also of typhous epidemics.

The question has been much agitated whether dysentery is a contagious disease. The profession is now almost universally agreed that it is not so in its ordinary form. The circumstances under which individuals are successively affected in epidemics have led to the opinion, with some, that most diseases assuming this character are propagated by contagion. When no obvious cause appears, and one person after another is affected in the same neighbourhood, or in the same family, it has always been a favourite conclusion with many that the complaint is communicated from individual to individual. But a closer examination has, in most cases, detected the error of this conclusion. There is little doubt that it is a mistake in relation to epidemic dysentery. In certain confined situations, where many dysenteric patients are crowded together, without due attention to cleanliness and ventilation, the disease appears to be communicated to others who may be exposed; but the result is probably owing to the influence rather of putrid exhalations, which are acknowledged to be capable of producing dysentery, than of any really contagious effluvium. Nevertheless, it must be admitted that the evidence is in favour of the occasional propagation of this complaint by contagion. The result may, perhaps, be best explained by the supposition, that, in cases of this kind, the dysentery is associated with the proper typhus fever, now generally admitted to be contagious, and that it is this disease which is actually communicated; the inflammation of the bowels being dependent upon some peculiar atmospheric or other incidental influence, as we occasionally see the same fever prevailing in certain districts, very generally attended with pneumonia.

Dysentery attacks indiscriminately persons of both sexes and all ages, and if one class of individuals is affected more frequently than another, it is probably owing to their greater exposure to the causes of the disease. It is much more prevalent in summer and autumn than in winter, and in hot than in temperate climates. Miasmatic countries are more subject to it than others; and strangers are more apt to be attacked in these countries than natives. In all ages, armies and garrisons have been peculiarly liable to suffer from it; and the records of campaigns and military marches are full of accounts of its devastating ravages.

Treatment.—A great variety of remedies have been employed in dysentery, and very different plans have been found successful under different circumstances. To be rational, the treatment must vary with the degree of violence in the disease, the existing state of system, and the diversities arising from associated affections. In ordinary uncomplicated colitis, the indications are simply those presented by inflammations in general; though some are more than usually prominent; as the relief of pain and distress, and the removal of causes of irritation whether applied directly to the affected part, or consisting in a congested state of the portal circulation. The modifications of treatment required by the state of system, and by the coexistence of other diseases, will be presented after an account of the remedies for simple dysentery. These are so numerous, as recommended by different practical writers, that it will be most convenient to consider the value of each remedy and its modes of employment, before describing the general course of treatment; as this would otherwise be constantly interrupted by the necessary remarks upon individual measures.

Bleeding is not necessary in all cases of dysentery, and, in the adynamic form of the disease, may be injurious. It should, however, always be resorted to when there is much pain and tenderness of the abdomen, with febrile action, and a vigorous pulse. As the disease generally occurs in temperate latitudes, and when not epidemic, one moderate bleeding will usually be sufficient; but, if the pulse remain firm, and the local symptoms unabated, it may be repeated again and again. In violent inflammatory cases, threatening immediate danger if not relieved, and especially in persons of vigorous constitution or plethoric habit of body, it may be necessary to bleed largely at once. In such cases, the remedy should be promptly resorted to, and the blood allowed to flow, until a decided impression is made on the pulse. If postponed, it may become useless or even worse than useless; as the powers of life are rapidly exhausted under the violence of the disease. It is seldom advisable to bleed in the advanced stages of dysentery, whatever may have been its previous character.

Emetics have been highly recommended by numerous authors, and are undoubtedly often serviceable at the commencement of the disease. Given at its very outset, they will sometimes effect an immediate cure. They were formerly, however, much more used than at present. The physician is generally called too late for their most efficient application; they are to most patients a very disagreeable remedy; and sometimes, when the stomach participates in the inflammation, or great abdominal tenderness exists, they may do positive harm. They are clearly indicated when the stomach is loaded with acrid accumulations of any kind, as shown by epigastric oppression, nausea, eructation of bile or other irritating matter, and frequent but ineffectual efforts to vomit, without the pain and tenderness of gastric inflammation. If employed with any other view, it should only be at the very commencement. Some have used the antimonial preparations; Chisholm recommended sulphate of zinc; but ipecacuanha is now generally preferred, and, from its mildness as well as efficiency, deserves the preference.

Cathartics are among the most efficient remedies. One of the most prominent indications in dysentery is to free the bowels from irritating secretions and accumulations; a second is to diminish congestion in the portal circulation; and both are best answered by this class of medicines. But it is necessary to use discrimination both in the selection of the articles, and in the circumstances of their application. Drastic purges produce more harm by irritating the inflamed membrane, than they can do good by their evacuating effect. Laxatives, therefore, or the milder purgatives should always be preferred. Nor is it in all cases advisable to persevere with them until feculent discharges, and especially consistent feculent discharges, are obtained. Occasionally, the dysentery has been preceded by a diarrhœa, which has cleansed the bowels;

and in such cases solid feces are not to be looked for in the stools. When the disease has commenced abruptly, without antecedent diarrhœa, it is generally proper to obtain at first a pretty brisk cathartic effect, and then to be satisfied with sustaining a gentle peristaltic movement, so as to keep the bowels free from irritating accumulations. It is better to run the risk of allowing some scybala to remain in the colon than to persevere with active purgation, when the great probability is, that there is nothing in the bowels which can require it. But another important object, in the use of purgatives, is to unload the portal veins. The capillary circulation in the liver is often sluggish, and in many instances the secretion of bile appears to be suspended. Blood, therefore, accumulates in the veins proceeding from the abdominal viscera, and must distend injuriously the capillaries of the bowels. By stimulating the hepatic circulation and secretion we remove this evil. Hence one great advantage of *calomel*. This is indeed one of the most useful cathartics in dysentery, having the advantage of mildness in its action on the mucous membrane, while it excites the liver. But, as it is not quick in its operation, and in moderate doses is sometimes uncertain, it should be assisted by other medicines. In ordinary cases, from five to fifteen grains of calomel should be given at the commencement, and followed in from four to six hours by the adjuvant. In severe bilious cases, it may be given in a larger dose at first, and subsequently repeated in the same quantity once or oftener; but, as we generally meet with the disease, if the medicine be repeated, it should be in small doses of from one to three grains, so as to sustain a moderate secretion of bile, which should be carried off by other cathartics. Of these, *castor oil* is on the whole probably the best. Should it offend the stomach in its ordinary form, it may be administered in emulsion with gum arabic, sugar, and some aromatic water. In the advanced stages of dysentery, this oleaginous mixture may often be advantageously combined with a little laudanum, and given in small divided doses at short intervals. Thus administered, it often produces a soothing effect on the bowels, while it operates as a laxative. Some prefer the *neutral salts*, as *sulphate of magnesia*, *sulphate of soda*, *tartrate of potassa and soda*, &c. These are especially applicable when there is much fever, with a hot dry skin. In such cases, they are sometimes associated with tartar emetic in solution, and given in divided doses, so as at once to relax the skin and operate on the bowels. Hufeland recommends a mixture of manna, tamarinds, Glauber's salt, and tartar emetic. When the stomach is irritable, the *Seidlitz powder* may be used. *Bitartrate of potassa* has been highly recommended as possessing peculiar powers. Dr. Cheyne found it in doses of half an ounce, repeated at intervals of four or six hours, to cure cases of dysentery which, in his opinion, would have sunk under any ordinary treatment. Some practitioners employ the *compound powder of jalap*. It is desirable that, by means of the cathartics mentioned, one or two evacuations, if not spontaneously produced, should be obtained daily or every other day, of such a character as to evince that they have come from the upper bowels. In the advanced stages of the disease, cathartics must be employed more sparingly than at the commencement; though even here, so long as the affection remains strictly dysenteric, they are often useful. When the strength fails, or the symptoms assume a chronic form, *rhubarb* or one of its preparations may be substituted for the other cathartics. Under the same circumstances, *melted butter*, prepared by introducing solid butter into hot water, agitating, and then skimming the oil from the surface, has been given advantageously in the dose of a tablespoonful every two hours, until it produced some effect upon the bowels. Great benefit will often accrue from combining an opiate with the cathartic. So far from uniformly counteracting the operation of the latter, it will not unfrequently promote it by resolving spasmodic constriction of the bowels, while it is also useful by relieving pain.

Diaphoretics are useful by giving an external direction to the circulating fluids, and by depleting from the blood-vessels; but, in consequence of the exposure of the surface from frequent rising, they are sometimes hazardous when the temperature of the apartment is much below that in which the patient is kept in bed. When the skin is hot and dry, small doses of tartar emetic, or of the neutral mixture, may be given separately or combined, at intervals of an hour or two. The effervescing draught is preferable when there is nausea or vomiting. Dr. Eberle speaks favourably of a combination of fifteen or twenty grains of aselepias tuberosa with half a grain of ipecacuanha, and a quarter of a grain of opium, every two or three hours. After the general excitement has been subdued by depletion, or has subsided in the course of the disease, and early in cases of feeble general action, the powder of opium and ipecacuanha is preferable to the refrigerant diaphoretics. Great advantage sometimes accrues from the *warm bath*, which is liable, however, to the same objection as diaphoretics internally administered. It is peculiarly useful in cases of children, because in these it can be managed with less exposure of the person to cold. The *vapour bath* may be substituted in the advanced stages. In all cases, the caution cannot be too carefully observed, not to allow the patient to be exposed to cold when the skin is moist. At the same time, he should never be kept oppressively hot by the bedclothes in order to promote perspiration.

Opium is an invaluable remedy in dysentery. Recommended by Sydenham, and afterwards neglected upon theoretical grounds, it came again into repute, and is now almost universally employed. Besides relieving the sufferings of the patient, and procuring sleep, which is necessarily much interrupted in this disease, it does good by diminishing the morbid sensibility of the bowels to the irritating matters they contain, by relieving spasmodic constriction and thereby facilitating the action of cathartics, and, when combined with ipecacuanha or tartar emetic, by directing action to the surface of the body. When there is much fever, it is best to postpone its administration until the force of the circulation has been reduced by the lancet; but in general the use of it may commence very early. It may be given along with cathartics, or combined with ipecacuanha, which somewhat diminishes its stimulant properties, and causes it to act as a diaphoretic. In the early stages, it is best administered in full doses, and generally at bedtime, so as to procure rest and sleep at night. In the advanced stages, it may often be usefully given in smaller doses, at stated intervals, so as to sustain a constant impression. Some rely mainly on large doses of opium after due depletion, in the treatment of the disease.

Mercury.—Not only is calomel useful in the commencement as a purgative, but afterwards also, in smaller doses, so as to stimulate the hepatic secretory function, and sustain a flow of bile into the bowels. For this purpose it is conveniently combined with the opium and ipecacuanha given at night. Two grains of opium, from two to four of ipecacuanha, and from two to four of calomel, may be made into four pills, two of which may be given at once, and one every hour or two afterwards till rest is procured. The ipecacuanha may be omitted if it should sicken the stomach, and the blue mass substituted for the calomel, if the latter should inconveniently irritate the bowels. If the disease should not begin to yield in six or seven days, the mercurial may be more freely administered, so as to affect the mouth. In severe hepatic or bilious cases, and in those of a typhoid character, unconnected with a scorbutic state of the blood, it may be carried to salivation at an earlier period.

When this indication is to be fulfilled, the mercurial, instead of being administered only at night, should be given in small doses at intervals of two, four, or six hours, still in combination with opium and ipecacuanha. The quantity of each ingredient must vary with the peculiar susceptibilities of the patient, and the urgency of the symptoms. No remedial influence is more effectual in dysentery than that of mercury. The chief cautions to be observed are to stop short of profuse salivation, and to avoid the remedy altogether in those malignant cases in which the blood is dark, and either feebly or not at all coagulable.

Numerous *alterative remedies* have enjoyed more or less credit in the treatment of dysentery. *Ipecacuanha* has been thought to exercise a peculiarly favourable influence, and some practitioners have confided the cure chiefly to that remedy. I have spoken of its use as an emetic and diaphoretic. It has been highly recommended in doses of from half a drachm to two drachms, with from thirty to sixty drops of laudanum; and it has been asserted that, if the patient be kept quiet on his back, it will in this quantity effect cures without producing nausea or vomiting. Mr. Twining, of Calcutta, found it very useful in doses of five or six grains, given night and morning, with compound powder of jalap in the interval. He administered it in pill with extract of gentian, and rarely observed it to occasion sickness of stomach.

Acetate of lead has been employed in all stages of the disease. The attention of the profession in this country was especially called to it by the late Dr. Harlan, of Philadelphia, who employed it successfully in acute cases; and several writers have since attested its efficacy. It is not, however, generally employed in the earlier stages. After sufficient depletion, and a thorough evacuation of the bowels, should the symptoms not yield, this salt may be given with some hope of advantage; but it is best adapted to chronic cases, and to those of an acute character which are attended with considerable hemorrhage. No remedy is perhaps so effectual in the hemorrhage of typhoid or malignant cases. It may be given in doses of from one to three grains every two hours, and should generally be combined with opium.

Sulphate of copper and *sulphate of zinc* have also been recommended. These are applicable to the advanced stages, and to chronic cases, when ulceration has taken place. They should be given in the ordinary doses, combined with opium, at intervals of two, three, or four hours.

Acids have sometimes been found beneficial. Much notice has been attracted by *Hope's mixture*, consisting of a fluidrachm of nitrous acid, forty drops of laudanum, and eight fluidounces of camphor water, of which one-fourth was given every three or four hours. The proportion of acid is too great, if of the officinal strength or near it; though perhaps not so, as the acid is usually found in the shops. Nitric acid is equally effectual; as the common impure preparation called nitrous acid is converted into the former by dilution. I have found this preparation useful in the advanced stages, and in chronic cases, but should not be disposed to employ it when the inflammation is acute, and attended with fever. *Nitro-muriatic acid* with laudanum may be employed under similar circumstances. The *vegetable acids* have also been recommended; and cures have been referred to the free use of *lemon-juice*, *vinegar*, and *pyroligneous* acid. Dr. Young, of Chester, Pennsylvania, has employed buttermilk with success, as the exclusive remedy in numerous instances. (*Am. Journ. of Med. Sci.*, N. S., iii. 260.) Cheyne's treatment by cream of tartar has already been referred to. There appears occasionally to be in dysentery a predominance of alkali in the secretions, indicating the use of this set of remedies.

Among the alterative remedies may also be mentioned *copaiba* and *oil of turpentine*. Given in emulsion with laudanum, in small and frequently repeated doses, these are certainly useful in some cases of advanced or chronic dysentery, and are probably more especially applicable to such as are attended with ulceration. In typhoid cases, a combination of oil of turpentine with castor oil in emulsion is sometimes an excellent remedy.

Peruvian bark has been recommended; but is applicable only to paroxysmal cases, or those requiring tonic and stimulating treatment.

Nux vomica has been much employed by the German physicians. It should never be used in the acute febrile stage of the ordinary sthenic form of the disease. In epidemic dysentery it is asserted to have proved very effective. (Cornell, *N. Y. Journ. of Med.*, N. S., iii. 122, from the *Charleston Med. Journ.*) Hufeland states that in obstinate cases it is very useful. The powder, extract, or active principle *strychnia*, may be given in the ordinary dose three or four times a day.

Dr. J. W. Sterling has employed powdered guaiac with great success in acute dysentery. He gave about two scruples in a wineglassful of sweetened mucilage three times a day. (*N. Y. Journ. of Med.*, N. S., i. 370.)

Dr. Frick, of Baltimore, has found a mixture of *naphtha and charcoal* very useful in certain cases of the disease, in its epidemic form. (*Am. J. of Med. Sci.*, N. S., xxii. 310.)

Aconite has recently been recommended in the dysentery of hot climates. (Marbot, *Archives Générales*, 4e sér., xxi. 214.)

The use of *yeast* has been suggested in the sloughing stage of the adynamic or malignant forms of the disease.

Sulphur, cerated glass of antimony, chloride of lime, nitrate of soda in the quantity of from half an ounce to an ounce in twenty-four hours, and *wax* both animal and vegetable, and in various modes of combination, have been recommended. Dysentery has also been treated by affusion of *cold water;* and Tissot asserts that he cured many cases by means of *warm water* alone, given in the quantity of a cup full every quarter of an hour. In relation to many of the above remedies, it is difficult to say whether the cure took place merely with them, or through them, or in spite of them.

Local Remedies.—As auxiliary to general bleeding, and in the place of it, when not required or forbidden, *cups or leeches* are of great importance. They should be used when there is much pain and tenderness; and should be applied along the course of the colon, where the tenderness is greatest. Leeches about the anus are peculiarly useful; and are especially adapted to cases in which there is severe tenesmus. The operation may often be advantageously repeated.

Fomentations and *emollient cataplasms* to the abdomen are also very useful, and are rendered still more so by anodyne additions, such as camphor, laudanum, and decoction of poppy capsules. Warm hop poultices often afford relief. Dr. O'Beirne, of Dublin, recommends fomentations with infusion of tobacco. Blane found great relief to be afforded by fomentations of chamomile with a little laudanum to the anus. The *warm hip-bath* is useful upon similar principles.

Rubefacient and *anodyne embrocations*, consisting of solution of ammonia, oil of turpentine, oil of monarda, &c., with laudanum or camphor, variously combined and diluted, may be employed, though they are less beneficial than the applications just mentioned. A broad flannel roller passed repeatedly around the body, so as completely to cover the abdomen, has been strongly recommended; but this is applicable rather to chronic than to acute dysentery. *Blisters* over the abdomen come in appropriately when these measures have failed; but they should never be applied until after sufficient depletion both local and general. Great relief may sometimes be obtained by sprinkling morphia on the blistered surface.

Large *emollient enemata* have been strongly recommended. They act as adjuvants to the cathartics, and are supposed to soothe irritation, and operate as poultices to the bowels. They undoubtedly afford occasional relief by diluting the acrid fluids, and, when composed of demulcent materials, in some measure protect the inflamed surface. But they sometimes also cause pain by distension; and the irritation about the lower rectum is increased by the mechanical disturbance. When found to yield comfort to the patient, they may be repeated daily or more frequently. In the early stages, warm water, solution of starch, and infusion of flaxseed, marshmallow, or bran, and, in the advanced stages with debility, veal-water, and mutton-water, are the proper materials. Melted butter has also been used with asserted advantage. *Opiate enemata*, or *suppositories*, are sometimes very useful in allaying the local distress. Dr. O'Beirne recommends injections of *infusion of tobacco;* but this remedy must be used with great caution. According to Dr. Kent, *very cold water* thrown up the bowels every half hour, speedily alleviates all the distressing symptoms. (*Phil. Journ. of Med. and Phys. Sci.*, x. 411); but it is necessary to take care that the system be not too far depressed by the remedy.

Injections of acetate of lead or *sulphate of zinc* are most valuable adjuvants to the general treatment, after febrile action has been moderated, and especially when the disease is confined chiefly to the rectum and lower colon. I have seen the happiest effects from these remedies; the disease being often almost immediately arrested by them after a long continuance. Acetate of lead is preferable when the affection retains its acute character; sulphate of zinc, when it verges towards the chronic state. Of either of them six or eight grains may be given in three or four fluidounces of water, with twenty or thirty drops of laudanum, and repeated once, twice, or three times daily. *Nitrate of silver* is said to have been employed in the same way very advantageously. From two to ten grains to a fluidounce of water have been used; and from three to six fluidounces thrown up at one time. Iodine has also been employed by injection, with great asserted advantage, even in recent cases. It is especially recommended by Dr. Eimer, of Germany, who administers, from twice to four times a day, an enema consisting of from five to ten grains of iodine, the same quantity of iodide of potassium, and two or three ounces of water, with ten or fifteen drops of laudanum, when the rectum is too irritable to retain the solution otherwise. (*Brit. and For. Med.-Chir. Rev.*, Am. ed., April, 1852, p. 424.)

Summary of the Course of Treatment.—In very mild cases without fever, it is often sufficient to give a single dose of castor oil, with or without twenty drops of laudanum. If the case be of a somewhat higher grade, a dose of calomel may be given at the commencement, and followed in a few hours by castor oil or sulphate of magnesia. If there should be evidences of a loaded stomach, and the physician be called early, he may add an emetic dose of ipecacuanha to the calomel. Should the symptoms increase, and fever with a strong pulse be superadded to the abdominal pains, the patient ought to be bled moderately from the arm; and, if this condition exist from the beginning, the bleeding should precede the other remedies. In violent inflammatory cases, it may be necessary to bleed very copiously. After the bowels have been thoroughly evacuated, and the patient bled if necessary, he may be allowed to rest for a short time upon cooling drinks and some one of the refrigerant diaphoretics, if the skin be hot and dry. Should the strength of the pulse and the local symptoms continue unabated, it may be proper to bleed again moderately, though this repetition of the remedy is seldom required, as the disease ordinarily occurs. If the degree of general excitement be not sufficient to call for the lancet, and considerable pain and tenderness exist, cups or leeches should then be employed, and warm fomentations or emollient cataplasms applied over the abdomen. The combination of opium, ipecacuanha, and calomel or blue mass, before alluded to, may be given at bedtime, and afterwards repeated daily at the same hour, being followed in the morning by a laxative. While this plan is in operation, the fomentations or cataplasms should be continued, the leeches or cups repeated if called for by pain and tenderness, mild refrigerants administered internally, the warm or vapour bath applied if circumstances should be favourable, and one or more of the various local measures before enumerated for the relief of tenesmus, resorted to. Should the disease not seem disposed to yield to this treatment by the sixth or seventh day, the mercurial plan, for which the foundation has been already laid, should be carried to a slight salivation; and, at the same time, if the local symptoms are violent, a large blister should be applied over the abdomen. The mercurial impression is in general most conveniently brought about by small doses of opium, ipecacuanha, and calomel or mercurial pill, repeated every two, four, or six hours, so that from two to three grains of opium, four to six grains of ipecacuanha, and four to six grains of calomel, or three times the weight of mercurial pill, may be given in twenty-four hours. If the system resist salivation, and the symptoms are urgent, the blistered surface of the abdomen may be dressed with mercurial ointment, and frictions with the ointment applied to the inside of the thighs. The disease seldom fails to yield to this treatment, unless considerable ulceration of the bowel exists. But the prejudices of the patient, the peculiarities of his constitution, or some other circumstance may forbid the employment of mercury. In this case, or in the event of a failure of the mercurial plan, some of the various *alterative measures* already enumerated (see *page* 602) may be resorted to, the choice being directed by the peculiar circumstances of the case. I would, however, invite an especial attention to the injections of acetate of lead and sulphate of zinc. (See *page* 604.)

The course of treatment above indicated applies to dysentery as it ordinarily appears. The bilious variety requires a more energetic employment of mercurial remedies. In the severer cases of this kind, calomel may be given in doses of fifteen or twenty grains daily, or of five grains three or four times a day, until some impression is made on the disease or upon the mouth. Upon the occurrence of salivation, the symptoms are almost always ameliorated. Opium may often be advantageously combined with the calomel; nor should the other measures, above detailed, especially general and local bleeding, emollient applications, and the means for relieving tenesmus, be neglected.

In dysentery associated with intermittent or remittent fever, the same course of treatment should be pursued as in the common form, so far as regards the bowel affection; but it is highly important also to bear in mind the indications presented by the general disease. The most striking of these is for the use of measures calculated to prevent the return of the paroxysm, and no remedy is so effectual for this purpose as Peruvian bark, or sulphate of quinia. It may be questioned whether this remedy should be employed before the cure of the dysentery; as the tonic properties of the bark might aggravate the inflammation. But the fact is, that the dysentery is a mere attendant upon the fever in this case, and is sustained by it; and whatever may cure the latter will be very likely to cure the former also. Whenever, therefore, an intermission is obtained, or a regular remission, with only so much general action in the interval as may be supposed to be sustained by the local disease, the sulphate of quinia may be safely given, after a thorough preliminary evacuation of the bowels, and the loss of blood, if that be deemed necessary. The quantity taken and the mode of administration should be regulated as in intermittent fever. Severe and obstinate dysenteries are sometimes rapidly cured in this way; the colitis ceasing almost immediately when the prop which supports it is removed. The prompt and free use of quinia is especially necessary, when, as sometimes happens in epidemics, the fever has a typhoid or malignant tendency. It is probably owing to the association of miasmatic fevers with the disease of the bowels, that some practitioners have met with extraordinary success in certain epidemic dysenteries by the use of bark, which is quite useless if not injurious in the ordinary form of the complaint.

In the *adynamic* or *typhoid* form of dysentery, which, it will be remembered, is apt to occur when the disease prevails *epidemically*, general bleeding and active purgation are not admissible; at least in such cases as exhibit this character at their commencement. An emetic of ipecacuanha is sometimes serviceable at the very beginning, and a moderate cathartic dose of calomel may be given if the patient is seen early. If it be afterwards deemed advisable, as often happens, to keep the bowels clear of irritating or depressing matter, this should be effected by medicines calculated rather to support than to weaken, such as infusion or tincture of rhubarb, or castor oil with oil of turpentine in small doses. In cases where the depression is not great, leeches may sometimes be useful. But the remedial measure on which reliance should be chiefly placed, is the mercurial impression, which should be effected by combinations of opium and calomel or blue mass, or of these with ipecacuanha, given in small and frequently repeated doses. This plan should be put in operation immediately after the patient is first seen, unless it may be considered proper to precede it by an evacuation of the primæ viæ. The only cases to which it would be inapplicable are those of excessive debility, or great malignancy, or of a scorbutic character. It is often necessary, in adynamic dysentery, to support the strength of the patient by stimulants, and nutritive drinks, such as carbonate of ammonia, wine-whey, wine and water, brandy and water, opium, infusion or decoction of bark or sulphate of quinia, oil of turpentine, egg and wine, animal jellies, chicken broth, &c., to which some writers add valerian, arnica, and the more stimulating aromatics. These remedies should be used with caution, and proportioned carefully to the degree of prostration. The mineral acids are also occasionally useful. In hemorrhage from the bowels, acetate of lead combined with opium and kino, is perhaps the most effectual remedy. Rubefacient embrocations over the abdomen are peculiarly useful in this form of dysentery; and a blister may be resorted to much earlier than in the disease as it ordinarily occurs.

Diet.—In very light cases, without fever, solid farinaceous substances, such as boiled rice, stale bread, crackers, &c., may be allowed; but in febrile cases, at least in the early stage, the diet should consist exclusively of mucilaginous or farinaceous drinks, which may be rendered more palatable by sugar and lemon-juice, if the patient desire it. Suitable preparations are solutions of gum arabic and arrow-root, thin gruels, infusions of flaxseed, slippery elm, and sassafras pith, and decoctions of barley, rice, sago, tapioca, and Irish moss. After the general excitement has somewhat subsided, rennet-whey may be given; and, in cases of great debility, animal jellies and broths. Sir G. Baker recommends mutton suet mixed with warm milk. In convalescence, the patient should, as a general rule, be confined to milk, butter, and farinaceous substances, until recovery is confirmed. Relapses are very apt to follow improper indulgence. Great care should be taken to keep the person of the patient and the bedclothes clean, to remove all excrementitious matters, to ventilate the apartment, and preserve the air sweet and pure, and, as far as possible, to remove the patient from the influence of causes which may have contributed to produce the disease.

2. **Chronic Dysentery.**—Chronic dysentery is often associated with chronic enteritis; and it is not always easy to determine how far the two portions of the bowels are severally involved in the inflammation. Nor is the decision a matter of much importance, as the treatment of the two affections is essentially the same, at least in those cases in which the symptoms are commingled. Chronic dysentery, when not thus combined, is readily known by the frequency and comparatively small quantity of the evacuations, their character, and the tenesmus with which they are attended. The greater number of the stools consist chiefly of mucus, sometimes mixed with a pus-like matter or blood. Occasionally, however, feculent or bilious matter is mixed with the proper dysenteric discharge. When the disease occupies the rectum and lower portion of the colon, the feculent discharge is often consistent, and, instead of being uniformly mixed with the mucus, is either irregularly pervaded by it in layers or streaks, or enveloped in a thick coating of it, derived from the surface of the bowel with which the feces lay in contact. There is usually more or less tormina, and tenderness on pressure; though the latter is by no means present in all cases. The pulse, skin, tongue, appetite, &c., are affected as in chronic enteritis; but the symptoms of general derangement are, upon the whole, less. When the disease is confined to the lower extremity of the bowels, the constitution often sympathizes but little. In such cases, the complaint sometimes continues for months or years, without making very serious inroads on the general health. But, for the most part, in chronic dysentery, if a favourable change is not effected by treatment, the patient gradually emaciates, the countenance becomes pale, sallow, and shrunken, the appetite fails, the general strength gives way, and ultimately the disease closes with hectic fever, anasarca, or some other form of dropsy. The association of chronic dysentery with a tuberculous constitution gives great obstinacy to the disease; and, in some cases, the inflammation of the mucous membrane of the colon is owing to tubercles diffused in the membrane, which finally soften and ulcerate. Occasionally the inflammation extends from the bowels to the venous trunks, especially the internal iliacs, and thence descending into the lower extremities, gives rise to the phenomena, in a greater or less degree, of phlegmasia dolens. (Mayne, *Dublin Quart. Journ. of Med. Sci.*, x. 375.)

Anatomical Characters.—Besides the usual signs of chronic inflammation in the mucous membranes, ulceration is very generally found in cases of death from chronic dysentery. An interesting fact is, that some of the ulcers are not unfrequently observed in a state of cicatrization, and others completely cicatrized, rendering it certain that patients may recover in this disease, even after extensive ulceration of the mucous coat. Abscesses of the liver are not unfrequently observed in chronic dysenteric cases; but whether they are to be considered in the light of cause or of effect, it is not easy to determine.

Chronic dysentery is seldom an original disease, but, when it occurs, is almost always the consequence of an acute attack. Slight cases of it, affecting only the rectum and lower extremity of the colon, may sometimes perhaps arise from an extension of inflammation from hemorrhoidal tumours.

Treatment.—The regulation of the diet is among the most important points in the treatment of this disease; and the same rules are applicable here as in the cases of chronic inflammation of the stomach and small intestines. General bleeding is scarcely ever admissible; but leeches may sometimes be applied when the pain and tenderness are considerable. When the disease is connected with chronic inflammation of the small intestines, cathartics are seldom required; as the bowels are sufficiently opened spontaneously. Indeed, in this case, the treatment is altogether so closely analogous to that directed for chronic enteritis, that it is sufficient to refer the reader to the account of that disease. In pure dysentery, especially when seated in the lower colon and rectum, it is often advisable to employ mild laxatives, in order to prevent morbid accumulation in the bowels above the part affected. This indication is presented when no fecal matter is passed in the course of the day. Small doses of castor oil, confection of senna, rhubarb, manna, or some other very mild laxative should be employed. When the pain is considerable, and the discharges frequent, opium and ipecacuanha should be given at bedtime, and with these calomel or the mercurial pill should be associated when hepatic action is deficient. Indeed, great powers over the complaint have been ascribed to the alterative action of the mercurial pill, independently of any disorder of the liver. Dr. J. K. Mitchell states, as the result of his observation, that most cases of chronic dysentery may be cured by the exclusive use of pure mucilage as a diet, and of the blue pill given once every day or every other day, in doses of from three to five grains. (*Am. Journ. of Med. Sci.*, ii. 323.) Pushed to moderate salivation, it will undoubtedly often effect cures; and this measure should always be resorted to if others fail. The various alterative medicines before mentioned as sometimes useful in the advanced stages of acute dysentery, are still more applicable to the chronic form of the disease. Such are sulphate of copper, sulphate of zinc, nitrate of silver, nitric acid, nitro-muriatic acid, Hope's mixture, a mixture of alum and sulphate of zinc as recommended by Moseley, copaiba, and the turpentines or their volatile oil. Moderate doses of these medicines should be given three or four times a day, and may often be usefully combined with from the eighth to the quarter of a grain of opium. Copaiba and turpentine are best administered in emulsion. I have seen the happiest effects from *oil of turpentine*, given in the dose of ten drops every two hours, in chronic dysentery, especially when attended with a *perfectly dry and smooth tongue*. Cases have repeatedly recovered under this remedy, which had long resisted others. One case of recovery I remember, in which the disease was considered quite desperate when the oil was first administered. I cannot too strongly press this remedy on the attention of the reader under the circumstances referred to. In two or three days, or sooner, the tongue begins to become moist, and to be covered with a delicate white fur, and there is a corresponding improvement in the intestinal symptoms. The oil should be given in emulsion, and associated with a little laudanum. The root of arnica is used by the Germans in the dose of a scruple every two or three hours. The vegetable astringents, formerly so much employed in chronic dysentery, though sometimes beneficial when the complaint borders on the character of diarrhœa, are generally, in the unmixed cases, worse than useless. Dr. Blackburn recommends strongly the wild strawberry leaves, which he employs in strong spirituous decoction, made by boiling a pound of the fresh leaves in two pints of brandy to a pint, and given in the dose of a tablespoonful every three hours. (*Bost. Med. and Surg. Journ.*, xxxvii. 342; from *South. Med. and Surg. Journ.*)

The warm or hot salt-bath, given every day, is one of the most beneficial adjuvants to internal remedies. Swathing the body with flannel, as recommended by Dewar, may also be resorted to. "Four or five folds of fine flannel, or a large piece of thick fleecy hosiery, ought to be laid over the abdomen, and, over this, a flannel bandage should be bound, rather tight, and in a uniform manner, from the groin nearly to the arm-pits and back again." (*Dewar on Diarrhœa and Dysentery*, p. 111.)

When the disease is confined chiefly or exclusively to the lowest portion of the bowels, I have found no remedy comparable in efficiency to injections of sulphate of zinc, given in solution along with a little laudanum, and repeated twice a day. (See *page* 604.) It is perhaps worthy of consideration, whether the remedy might not be advantageously employed by injection through a tube, in cases where the more remote portions of the colon are affected. There can be little doubt that it operates by a direct alterative influence on the surface which it touches, exactly as in ulcerations of the mouth.

In relation to clothing, exercise, &c., the same observations apply here as in the case of chronic enteritis.

Article II.

CANCER OF THE BOWELS.

This is a rare disease. All portions of the intestinal canal are not equally liable to it. The parts most frequently affected are the duodenum, cæcum, rectum, and sigmoid flexure of the colon. There are in general no means by which the disease can be certainly distinguished in its earlier stages. It is often for a long time latent, or attended only with occasional pain or uneasiness, which is usually referred to some other cause. No decided symptoms appear until the tumefaction has become so considerable as materially to interfere with the passage of the contents of the bowels, or until ulceration has taken place so as to occasion great pain in their passage, or until the disease has begun to involve other structures. Obstinate vomiting and constipation are symptoms which usually mark its encroachment upon the cavity of the bowel. Along with these are paroxysms of severe lancinating or spasmodic pain, extending from a particular spot over the abdomen. The pain usually comes on at a certain time after eating, longer or shorter, according to the distance of the disease from the stomach. When the complaint is seated in the cæcum or below, there is usually great and distressing abdominal distension from feculent accumulation and flatus, and the patient is much troubled with eructation of air. Stercoraceous vomiting sometimes occurs, when the obstruction is very great. In some cases, however, a sufficient passage remains open from the beginning, and the patient suffers comparatively little from vomiting, constipation, and abdominal distension. In others, the passage is enlarged by ulceration, or a new one is created, and temporary relief is obtained from these alarming symptoms. Sometimes diarrhœa occurs, with bloody, glairy, gelatinous, sanious, or otherwise disordered evacuations; and, in the latter stages, the passages are often very offensive. The extension of the disease to neighbouring organs, as the liver, pancreas, kidneys, &c., gives rise to various complications of the symptoms. The patient emaciates rapidly; the countenance assumes the peculiar cancerous pallor; the pulse becomes frequent; edematous effusion takes place; and the patient dies, worn out with pain, loss of blood, and general irritation. In some cases, death occurs more suddenly, as the result either of complete obstruction of the bowel, or of peritoneal inflammation consequent upon ulcerative perforation. The diagnosis between cancer and other organic affections of the bowels is not always easy. It is, however, very much assisted, when, as often happens, a tumour can be felt through the abdominal parietes, corresponding with the seat of suffering.

The phenomena presented by cancer in different parts of the bowels are not exactly the same. When it affects the *duodenum*, there must obviously be less of the distressing distension of the bowels, while the patient is in a still greater degree troubled with vomiting, which, as well as the greatest severity of pain, comes on generally from two to four hours after eating, when the chyme passes out of the stomach. When the *cæcum* is the seat of the disease, the obstruction is often very great, in consequence of the valve becoming in a greater or less degree affected; although a case has been recorded by Dr. T. E. Beesley, in which the passage was even larger than is usual in health, notwithstanding a great thickening of the parietes. (*Phil. Journ. Med. and Phys. Sci.*, vi. 350.) In cancer of the *rectum*, there is less disposition to vomit than when the upper part of the canal is affected, and less general disturbance of health until the complaint has made great advances. The tenesmus and great but often ineffectual straining, the discharges of feces in a flattened tape-like form, or in slender cylinders not thicker than a quill, or in other distorted shapes, and the acute lancinating pains in the region of the sacrum, extending down the limbs even to the feet, will be sufficient to indicate the necessity of an examination of the rectum, in which the finger will encounter a stricture, more or less completely surrounded by an almost cartilaginous hardness. When to these symptoms are added an ichorous fetid discharge, and an extension of irritation to the vagina in females, and to the bladder in males, there can be little doubt as to the nature of the disease.

In all these cases, dissection shows the same morbid structure as in cancer of the stomach. Sometimes the whole parietes of the bowel are thickened, and the passage contracted to the size of a crow's quill; sometimes irregular indurated tumours, or others of a medullary character are found projecting into the cavity of the intestine. Ulceration of various extent is discovered, not unfrequently penetrating into neighbouring parts, which have become agglutinated with the bowel in a mass of cancerous disease. Contiguous convolutions of the intestines have been found thus agglutinated; and a passage, made by ulceration through their coats, is one of the means by which that sudden relief from the most imminent danger, which occasionally marks the progress of a case of intestinal cancer, is produced.

Treatment.—Only palliative measures can be employed. If there be some doubt whether the case may not be simply chronic inflammation of the bowels, the treatment for this affection should be employed, and the more especially as, though it cannot cure, it may somewhat alleviate the complaint if really cancerous. The chief indications in cancer of the bowels are to facilitate the passage of the intestinal contents, and to allay pain. The former is answered by the use of a laxative diet, and of laxative medicines, the latter by opium, conium, or hyoscyamus; care being taken to counteract the constipating effect of the first of these narcotics. Opiates may be used by the mouth, or rectum, or by the endermic method. When the disease is in the rectum or lower colon, relief may be obtained by the use of demulcent enemata, which penetrate the stricture, and, by diluting the feculent accumulation above, facilitate its passage. These may sometimes be advantageously thrown up by means of a gum elastic tube previously passed through the stricture. A bougie may be occasionally employed to obtain present relief from distressing flatulence, &c., but not with the view of effecting permanent dilatation. The diet should be light, digestible, and nutritious, without being stimulant; and substances should be preferred which yield but a small proportion of excrementitious residuum. Farinaceous substances, animal broths, milk, cream, and the most digestible of the laxative fruits, whether fresh or dried, may be allowed. Milk is peculiarly suitable.

Article III.

IRRITATION OF THE BOWELS.

This, as in the case of the stomach, may be vascular, affecting especially the mucous membrane, or nervous, affecting the muscular coat, or both at once. Diarrhœa, the different forms of colic, flatulence, spasm of the rectum, and hemorrhoids may come under this head, though all occasionally associated with a debilitated condition of the bowels.

1. DIARRHŒA.

Those cases are denominated diarrhœa in which the alvine evacuations are more liquid, frequent, and copious than in health, without being hemorrhagic or dysenteric in their character.

The affection is rather a consequence of certain pathological conditions than itself a disease. These conditions are various, and sometimes even opposite; as is rendered obvious by a consideration of the different agencies which may produce increased evacuation from the bowels. A simple increase of the peristaltic action may have this effect, without the co-operation of any other cause. It may also result from an elevated excitability of the bowels, causing them to receive a stronger impression from their usual contents than in health, or from an increase in the quantity or stimulating quality of the ingesta acting upon the ordinary excitability, or from a condition of the digestive organs, allowing bland materials introduced into the stomach to undergo changes which may render them irritant. Again, irritation or inflammation of the intestinal mucous membrane may produce secretions, which, from their quantity or quality, shall prove purgative; and, in one portion of the alimentary canal, matters may be generated which shall operate in this way upon another portion further down. The biliary and pancreatic secretions, moreover, may be so altered as to excite the bowels to increased action, though the latter may be in perfect health. Finally, debility of the mucous membrane may allow the elimination of fluids, which, by mere distension of the bowel, shall cause the muscular coat to contract more rapidly. These are very different conditions, yet all attended with diarrhœa. The only common circumstance is increased peristaltic action.

With this diversity in the sources of diarrhœa, there is an equal diversity in the attendant symptoms; and there is scarcely any phenomenon common to all the varieties except those mentioned in the definition. The evacuations may be very few, not exceeding two or three daily, or so frequent that the patient scarcely satisfies one call before he experiences another. Their quantity, which is sometimes but little greater than in health, has been known to amount to forty pounds in a day. (Dalmas, *Dict. de Méd.*, 2e ed., x. 271.) There is generally more or less pain before the evacuations, which are almost always followed by relief; but in some cases no pain whatever is experienced throughout. Along with the discharge is occasionally a very disagreeable sinking sensation in the abdomen, with a general feeling of exhaustion or faintness, a cool skin, and a feeble irregular pulse. This condition, however, is almost always temporary. Diarrhœa is sometimes attended with fever, which is generally an indication of inflammation, or very high and extensive irritation of the mucous coat. But in the great majority of cases there is no fever. The skin is usually dry, and the urine scanty. Every possible diversity exists in the degree, duration, and danger of the complaint. It may be quite trivial, getting well in a day or two without aid, or may run on for months and even years, resisting every variety of treatment. In some rare cases, death occurs suddenly from great exhaustion, even while the patient is on the stool. But, more commonly, a fatal termination is preceded by a slow emaciation and gradual failure of strength. Very protracted and fatal cases are generally connected with tuberculous or cancerous lesions of the bowels, organic disease of the liver, or a scorbutic state of system. In simple diarrhœa, whether acute or chronic, without organic lesion, the prognosis is almost always favourable, provided proper treatment can be applied.

In reference to the pathological condition of the bowels, three varieties of diarrhœa may be recognized: 1. that in which the increased peristaltic movement results from causes acting directly on the muscular fibre, with a perfectly healthy state of the mucous membrane; 2. that in which it is brought about through irritation or inflammation of the membrane; and 3. that in which it proceeds indirectly from debility of the membrane.

1. *Diarrhœa from Increased Peristaltic Action alone.*—Of this kind is probably the looseness of bowels induced by terror or other sudden and strong emotion, which appears at the same time to relax the sphincter and excite the peristaltic action. The same result is sometimes seen in hysterical or other nervous affections; and to this head, moreover, we may refer the *crapulous diarrhœa* of great eaters, in which the exciting cause of the increased peristaltic movement is probably distension of the bowels, which is felt as a direct stimulus by the muscular coat. In these cases, the stools are always fecal, and usually semiliquid, and of a healthy colour. The affection is very slight and yields without difficulty.

2. *Diarrhœa from Inflammation or Irritation of the Mucous Membrane.*—This is beyond all comparison the most frequent of the three varieties referred to. Inflammation of the membrane has been already sufficiently considered under the head of *enteritis.* The remarks which follow, therefore, have reference to irritation of the bowels; although it is often very difficult to decide between the two conditions, as they run into each other by insensible shades. Diarrhœa of irritation may exist independently of any concurrent disorder in other parts of the system, or may originate and be sustained by such disorder. Upon this difference of origin two sub-varieties may be founded. In both there is often a morbid predisposition in the alimentary mucous membrane, rendering it susceptible to impressions which it would not feel under ordinary circumstances. This predisposition consists in an increased excitability, which is little else than the first step towards positive irritation. Such a condition is induced by continued exposure to heat, and is often left behind by idiopathic fevers and other acute diseases. Hence in part it is, that diarrhœas are most prevalent in summer, and are so apt to occur during convalescence. The same predisposition may also arise from any of the ordinary causes of irritation, acting in a degree insufficient to bring on obvious disease. Thus, under the continued influence of fatigue and improper diet, exposure to cold will occasion an attack of diarrhœa, which neither the former nor the latter cause alone might have been sufficient to produce. Here a slight and latent irritation is provoked by a new cause into open violence.

a. From irritation of bowels independent of disease elsewhere.—This may be produced by causes acting either directly upon the mucous membrane, or intermediately through the system. Of the causes acting directly, the most prominent are insufficiently masticated or indigestible food; acidulous and saccharine fruits, such as cherries, plums, melons, &c., particularly when unripe or used in excess; spoiled meats, and mouldy or corrupted provisions of all kinds, such as are often used in armies and on shipboard; newly and imperfectly fermented or spoiled liquors, as new cider, table beer, sour ale or porter, spruce and ginger beer, &c.; certain natural waters, especially limestone water in persons unused to it; sour milk, or the milk of unhealthy nurses;[*] cold water in excess; acid or other irritating matters resulting from spontaneous changes in the food, after introduction into the stomach; worms and collections of feculent matter in the bowels; and the abuse of irritating, stimulant, or purgative medicines. Particular kinds of food always induce diarrhœa in certain individuals, in consequence of idiosyncrasy. Of the exciting causes acting through the system *cold* is by far the most common. This, however, alone is seldom sufficient to produce diarrhœa. It is after previous exposure to heat, and especially when the body is perspiring, that it acts so energetically. The diarrhœa induced in this way is denominated by some writers *catarrhal*, probably because attended with increased serous or mucous secretion; by others rheumatic, from the similarity of its cause with that producing rheumatism, though any other irritation or inflammation resulting from cold might with just as much propriety receive the same designation. Nevertheless, a rheumatic or gouty predisposition is sometimes called into activity in the form of diarrhœa; and this complaint not unfrequently results from the translation of *rheumatism* or *gout* from some other part of the body to the bowels. Sometimes very sudden and alarming discharges from the bowels are brought on in this way. In like manner, the *retrocession of cutaneous eruptions*, and the *cessation of some habitual discharge* either natural or artificial, occasionally produce diarrhœa. *Fetid exhalations*, and the continued influence of anxiety or other *mental disturbance*, are also capable of calling into action this form of intestinal irritation. It is probable that *vegetable miasmata* have the same effect. Diarrhœa is very apt to accompany *epidemic cholera* and *dysentery*, sometimes acting as a forerunner to them, and often, during the continuance of the epidemic, preceding individual attacks of those diseases, so that the practitioner frequently has it in his power, by a proper management of the diarrhœa, to prevent a much more serious affection. In these cases, however, the diarrhœa is frequently associated with hepatic derangement, and might fall under the following variety.

In diarrhœa of irritation, proceeding from the above mentioned causes, the stools are more or less fecal, often of the healthy colour, though sometimes green from the action of acid upon the healthy bile, and occasionally somewhat bloody, when the irritation is very severe, or a hemorrhagic tendency exists. In some instances they are copious and watery, constituting the *serous diarrhœa* of authors; in others, chiefly composed of mucus, in which case the disease is sometimes denominated *mucous diarrhœa*. Not unfrequently portions of the food undigested are found in the stools, and in some instances this constitutes the chief feature of the affection. Such cases are always connected with a feeble digestion. They were formerly designated by the name of *lientery*. In the diarrhœa of infants nothing is more common than to find undigested coagula of milk in the passages.

b. Dependent on hepatic derangement.—Of this variety of diarrhœa there are three distinct forms, characterized respectively by an increased, perverted, and diminished secretion of bile. 1. The first form, or that connected with an increased secretion of bile, is commonly called *bilious diarrhœa.* The stools are liquid, of a bright-yellow colour, sometimes green, from the action of acid in the bowels, generally rather frequent, and attended with considerable tormina, and a burning or otherwise painful sensation in the rectum during the discharge. Some excitement of the circulation is not unfrequent. The bile is, in these cases, the direct cause of the intestinal irritation, by coming in greater quantity than usual into contact with the mucous membrane. An aggravation of the affection, attended with vomiting, constitutes cholera morbus. 2. The second form differs from the first only in the circumstance that the bile is secreted not only in abnormal amount, but of an unhealthy or perverted character. The stools are brown, or black, or otherwise deranged in colour, and not unfrequently of a tarry consistence. In bad cases, they are sometimes very profuse, and exquisite pain attends the passage of the bile through the bowels. It is important to distinguish the passages, in these cases, from those black discharges which depend on intestinal secretion or hemorrhage, as the treatment required is different. In the bilious cases, however black the stools may appear in mass, they always exhibit a yellowish tinge, if viewed in very thin layers. This perverted secretion, though perhaps in most cases dependent on mere functional derangement of the liver, is often also connected with serious organic disease of that organ. 3. The third form is wholly different in character from the two preceding. In this, the biliary secretion is much diminished or entirely suspended. The evacuations are consequently light-coloured, and often of a dirty white, being more or less colourless as they are more or less deprived of bile. They are usually opaque, and sometimes almost milky in appearance. Hence, they have been supposed to consist of chyle; but they are in many instances too copious to allow of the truth of this supposition. When very abundant, they resemble somewhat the rice-water evacuations of cholera. In most instances, the diarrhœa appears to depend upon the suspension of the hepatic secretion, and very soon ceases upon its restoration. Congestion probably takes place in the intestinal mucous membrane, in consequence of a torpid capillary circulation in the liver, and relieves itself by secretion from the distended vessels. Occasionally it is possible that the case may be reversed, and a profuse secretion from the bowels, consequent upon intense irritation, may diminish that supply of blood to the liver which is necessary for the formation of bile. The former, however, is a much more frequent occurrence. It is highly probable that the two pathological conditions occasionally coexist. This form of diarrhœa, though attended with less acute pain than the two preceding, is often very distressing from a feeling of indescribable uneasiness in the abdomen with depression of spirits, is obstinate unless properly treated, and sometimes produces fatal exhaustion. As it ordinarily occurs, it may almost always be speedily arrested by suitable remedies, and hence the importance of an early inspection of the evacuations.

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[*] Dr. Vogel has found, upon microscopic examination, in the milk of nurses which has proved unwholesome to children, even when quite fresh, *infusoria* such as are observed in incrustations upon the teeth; little rod-shaped bodies, dark in the middle, without head or tail, but with numerous feet, and often swimming actively in the liquid. Children fed on this milk are attacked with diarrhœa, which ceases on substituting good cows' milk. (See *Am. J. of Med. Sci*, N. S., xxvii. 204.)

It is obvious that the various forms of diarrhœa above described may be more or less mingled one with another, and that from such an admixture an almost infinite variety of appearance may be given to the passages.

c. *Occurring sympathetically in various diseases.*—Diarrhœa is a very common attendant upon teething, in which, when not severe, it sometimes forms a useful outlet for irritation, and should not be too hastily arrested. In such cases attention should be directed especially to the gums. (See *Morbid Dentition.*) It frequently supervenes in the course of febrile affections, especially the exanthemata. Thus, it is common in scarlatina and smallpox. It has already been spoken of as attendant upon the thrush or sore-mouth of children. But in these cases, as well as in typhoid fever and phthisis, the diarrhœa depends rather upon inflammation of the bowels than mere irritation. In the course of dropsy, and at the close of febrile complaints, attacks of diarrhœa sometimes come on, which appear to be an effort of nature to relieve the morbid condition of system. Thus, a paroxysm of fever sometimes goes off with increased secretion from the bowels instead of perspiration. In such cases, the diarrhœa has been called critical, and should not be too hastily interfered with.

3. *Diarrhœa of Debility.*—Diarrhœa may depend upon debility of the mucous membrane of the bowels, with or without antecedent inflammation. The most numerous cases of this kind are undoubtedly those which, originating in inflammation, continue after all inflammatory action has subsided. The capillary vessels and secreting orifices, enlarged during the inflammation, are left by the subsidence of the excitement too feeble to contract vigorously, and the more fluid parts of the blood escape, with more or less modification, according to the greater or less amount of remaining energy in the vessels. Of this character may even be considered the diarrhœa attended with chronic ulcers of the bowels, which are too feeble or indolent to take on the healing process. But occasionally we meet with this disease, without any previous intestinal inflammation or irritation which can be recognized. The eliminating tissue appears too feeble to resist the force with which the blood is moved; and the serous and even fibrinous parts of the blood escape, attended sometimes with more or less of the red colouring matter. An increased degree of the same affection constitutes passive hemorrhage. It is not unfrequently associated with a watery condition of the blood, which becomes incapable of sustaining a due energy in the extreme vessels. An example of this kind is afforded in the colliquative diarrhœa of phthisis, which, though generally associated with ulceration of the mucous membrane, sometimes occurs without any evidence of organic disease in this structure, alternating with the colliquative sweats which depend upon the same cause. Diarrhœa of debility is generally without pain or tenderness of the bowels, and without febrile excitement. Nevertheless, in the mucous membrane of the bowels as in other parts, debility and inflammation may coexist, in which case the symptoms would be modified.

Treatment.—This must vary with the character of the disease. In relation to the treatment of diarrhœa, the propriety of inspecting the evacuations cannot be too strongly urged. When the complaint depends simply upon increased peristaltic movement, it usually subsides with the cessation of the cause. Should it require treatment, from five to ten drops of laudanum, or a fluidrachm of camphorated tincture of opium may be given, and repeated if necessary. In the crapulous form, the loaded bowels may be relieved by castor oil or other mild cathartic, and the diet afterwards reduced in quantity, and made to consist of materials which yield a comparatively small proportion of excrement, as meats, milk, and farinaceous substances.

The treatment for inflammatory diarrhœa has already been detailed. (See *Enteritis.*) In diarrhœa of irritation, respect must be had to the cause. If slight, without discoloration of the passages, without febrile excitement, and with little or no griping, the case will in general require scarcely anything more than a regulation of the diet. If the presence of irritant substances in the bowels is suspected, a dose of castor oil should be given with or without laudanum, according as the pain is considerable or otherwise. When the stools are green or of a sour smell, or other evidence of acid in the primæ viæ is presented, magnesia, or a mixture of this with rhubarb, should be substituted for the oil. Purging, however, has been abused in this complaint. It should not be carried further than is necessary to evacuate irritant substances.

In some rare cases, collections of feculent or foreign matters in the bowels, somewhat difficult to dislodge, maintain a vexatious diarrhœa, which can be removed only by a removal of the cause. In such cases, the cathartics already mentioned may be repeated, or others more active resorted to. When worms are the offending cause, calomel is the most efficient cathartic, and should be given in connexion with vermifuge medicines. These cases, however, are rare; and, in general, a single dose of the cathartic is sufficient. In cases not requiring laxatives, and in others, after the proper use of these medicines, opiates are the most efficient remedies. If the irritation be moderate, and wholly unattended with arterial excitement, from five to ten drops of laudanum, with or without a little camphor water, or a fluidrachm of camphorated tincture of opium, repeated two or three times a day, will generally arrest the disease. If the symptoms of irritation are high, and the case borders on inflammation, it may be proper to bleed moderately. In such cases, and even in those of a milder character, the opium may be advantageously combined with ipecacuanha, when the patient is confined. This combination is peculiarly suitable at bedtime. When acid continues to be generated, prepared chalk or prepared oystershell should be added to the anodyne, or, if these do not suit the stomach, and especially if there should be a slight febrile action, carbonate or bicarbonate of soda or potassa should be substituted. If by these means the discharge is not arrested, and the patient complains of little or no pain, one of the vegetable astringents may be added, such as logwood, kino, catechu, rhatany, geranium, or pure tannic acid. The more bitter astringents should be avoided at this stage. These various remedies may often be conveniently combined in mixtures, of which the precise form must differ with the circumstances of the case. A suitable vehicle for them is diluted cinnamon water, and insoluble substances should be suspended by means of gum arabic and sugar.* It is best, as a general rule, to give the mixtures in small doses frequently repeated. If the astringents are found to increase the pain, they should be omitted.

In bilious diarrhœa with bright-yellow or green passages, a gentle cathartic may first be administered with or without laudanum, and then small doses of calomel and opium, about the sixth of a grain of the former to the twelfth of a grain of the latter, for example, every hour or two. The sixth of a grain of ipecacuanha may be added to each dose, if there is no nausea. Not more than two grains of the mercurial should, in general, be given in this mode during the day. Should there be fever and much pain, a little blood should be taken from the arm, and the refrigerant diaphoretics administered, the patient being confined to his bed. In cases attended with black or very dark bilious evacuations, the alterative mercurial plan should in general be commenced immediately, and continued until the colour is changed. When the discharges are not copious, and the pain not severe, the calomel may be given without opium. Advantage is sometimes derived, in these cases, from alternating the mercurial with the syrup or infusion of rhubarb.

In the form of diarrhœa attended with white passages, it is often highly important to stimulate the liver as speedily as possible. When the stools are small, and the patient not materially weakened, from five to ten grains of calomel may be given at once. In children two or three years old, one or two grains of calomel may be given every two hours until it produces some effect on the bowels, care being taken not to exceed four or six grains. The happiest effects sometimes immediately result. But if the passages are somewhat copious, or the patient feeble, the calomel should be given with opium, or the compound powder of ipecacuanha, and followed by some preparation of rhubarb, or a little castor oil, if the bowels should be confined. The alterative plan may afterwards be followed, by giving smaller doses of the mercurial with opium or Dover's powder. When the evacuations are alarmingly copious and exhausting, I have found great advantage from small and frequent doses of calomel, opium, and acetate of lead.[*] In infants, affected with this or any other form of bilious diarrhœa, which in them is very generally attended with acidity, I can from experience recommend the formula below.[†] If the alterative mercurial plan fail in these cases, or circumstances prohibit its employment, nitromuriatic acid, with or without laudanum may be substituted, and will sometimes operate most happily on the hepatic function. Should the diarrhœa continue after the secretion of the liver has been corrected, it should be treated as cases of simple irritation.

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* The chalk mixture of the Pharmacopœia is a convenient formula for the administration of chalk, and the same will answer for oystershell. The dose is a tablespoonful repeated several times a day. Opiates being generally indicated at the same time, from five to ten drops of laudanum, or from f℥ss to f℥j of camphorated tincture of opium, may be added for every fluidounce of the mixture. If the vegetable astringents are employed, from ten to twenty grains of kino, catechu, extract of logwood, or extract of rhatany, or from two to four grains of tannic acid, should be added to the same quantity. Logwood, rhatany, and geranium may also be conveniently used in decoction or infusion; and these preparations may be used as the vehicle of the chalk, and of the laudanum or paregoric.

Sulphuric acid, which has long been occasionally used in diarrhœa, has recently attracted much attention in England as a remedy in this disease, and, according to the statements in the journals, has proved successful in a most extraordinary degree. From twenty to thirty minims of the officinal diluted acid (*acidum sulphuricum dilutum*) are given every hour, two, or three hours, in about two fluidounces of water or other vehicle; and, in very urgent cases, the dose is still more frequently repeated. It seems to be especially applicable to diarrhœa of irritation.[‡]

Creasote has also been very highly commended. Mr. Kesteven, who employed it upon the recommendation of Mr. Spinks, of Warrington, speaks of it as being signally beneficial in every case, generally checking the disease at the first dose, and very seldom requiring to be repeated more than once. He gives from one to five minims, mixed with aromatic spirit of ammonia in about a wineglass-full of water. (*Lond. Med. Gaz.*, N. S., xii. 235.) Dr. J. R. Cormack states that, if two or three drops can be taken twice, at the interval of an hour or two, it scarcely ever fails (*Association Med. Journ.*, Nov. 11, 1853); and Dr. Woodson, of Sumner Co., Tennessee, found it more successful than any other remedy which he had ever used. (*Am. Journ. of Med. Sci.*, N. S., xxiv. 237.)

In diarrhœa of debility, in which may be included most cases of chronic diarrhœa not attended with pain or fever, after correcting the biliary secretion if deranged, we may resort to astringents and tonics, of which a vast variety have been recommended. Among the vegetable astringents may be enumerated, besides those already mentioned, galls, oak bark, blackberry and dewberry root, black alder, alum root, pomegranate, &c.; among the tonics, columbo, gentian, quassia, simaruba, angustura, cascarilla, &c. These may be tried, separate or variously combined, in decoction or infusion, flavoured with cinnamon or orange peel, and with some hope of advantage. Nux vomica has been recommended as having peculiar efficacy. But, on the whole, more good may be expected from the mineral substances belonging to the same classes, especially alum, acetate of lead, sulphate of copper, sulphate of zinc, nitrate of silver, and the various chalybeates. With all these remedies it is usually proper to combine opium. When there is reason to suspect ulceration of the bowels, sulphate of copper in the dose of one-quarter of a grain, with the sixth of a grain or more of opium, given four times a day, I have found a most effectual remedy. Of the chalybeates, the solution of nitrate of iron (U. S. Ph.) has of late years acquired considerable reputation; but, in my own experience, it has not proved superior to the other preparations of the same metal. Ergot was used successfully by Dr. Stout, of Bethlehem, Pennsylvania, in the dose of six grains three times a day, in a case which had long obstinately resisted tonic and astringent treatment. (*Phil. Journ. of Med. and Phys. Sci.*, vi. 118.) M. Rayer employs subnitrate of bismuth, with great advantage, in the diarrhœa of phthisis, that of typhus fever, and in the cases of children. (See *Am. Journ. of Med. Sci.*, N. S., xiv. 219.) M. Monneret uses the same remedy, with great asserted success, in the atonic diarrhœa of children, in the quantity of two drachms gradually increased to twelve drachms daily. (*Ibid.*, xviii. 462.) He considers the remedy innocent in these large doses; but, never having employed them, I cannot speak of them from my own experience. When stimulation is requisite, good port wine should be preferred. For the treatment especially applicable to the diarrhœa of chronic enteritis, the reader is referred to that disease.

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[*] ℞.—Hydrarg. Chlorid. Mit. gr. ij; Opii gr. j; Plumbi Acetat. gr. vj. Misce, et fiant pil. no. xii. S. One to be taken every half hour.

[†] ℞.—Testæ Præparat. ʒss; Tinct. Opii gtt. vj; Pil. Hydrarg. gr. iij; Acaciæ pulv., Sacch., āā ʒss; Aquæ Cinnam. f℥ss; Aq. fluvial. f℥j. Misce. S. A teaspoonful to be given at intervals of two, four, or six hours, or less frequently.

[‡] See a communication by Dr. *H. W. Fuller*, in the *Lond. Med. Times and Gaz.* (Jan. 1852, p. 31), and various other communications in the same journal, and the *London Lancet*, in the years 1851 and 1852.

There are various accessory measures which may be resorted to, in any of the forms of diarrhœa. Of these, the warm-bath, in acute cases, when the skin is warm and dry, the hot bath, and especially the warm salt-bath, in chronic cases when it is cool and pale, are perhaps the most efficient. They may be used with great advantage in the cases of children. A bath of decoction of oak bark has been recommended in similar cases. Benefit may also be expected from a flannel roller about the body. Frictions to the surface are decidedly useful, when the cutaneous circulation is languid; and rubefacients or blisters to the abdomen may be tried in obstinate cases. Anodyne enemata are sometimes highly serviceable in allaying the intestinal irritation. Warm clothing, with flannel next the skin, is important. This precaution is too often neglected in children, whose feet, legs, and arms, are apt to be exposed unprotected to the changes of temperature, which they are less able to bear than adults. Regular exercise should not be neglected in chronic cases, when the patient is in a situation to take it.

Diet.—Attention to diet is indispensable. In many cases, indeed, no other remedial measure is necessary, especially when the disease has originated from improper food. In infantile diarrhœa, it is important to ascertain whether the milk of the nurse is healthy, and, if there is reason to suspect that it is otherwise, to substitute another nurse, or to remove the child from the breast altogether. The farinaceous substances, such as stale or toasted bread, water crackers, and boiled rice, constitute a suitable diet in the early stages of diarrhœa of irritation. Milk is admissible in mild cases. Farinaceous drinks may be employed when the irritation is considerable, and especially when the stomach participates in it. Fresh vegetables and fruits should, as a general rule, be avoided. Whatever is eaten should be thoroughly masticated. For infants, fresh milk, diluted with water, and thickened with arrowroot or pulverized water-crackers, constitutes a good diet; but, when there is fever or evidence of acute inflammation, the food should consist exclusively of mucidren. But in these cases, as well as in typhoid fever and phthisis, the diarrhœa depends rather upon inflammation of the bowels than mere irritation. In the course of dropsy, and at the close of febrile complaints, attacks of diarrhœa sometimes come on, which appear to be an effort of nature to relieve the morbid condition of system. Thus, a paroxysm of fever sometimes goes off with increased secretion from the bowels instead of perspiration. In such cases, the diarrhœa has been called critical, and should not be too hastily interfered with.

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expression of the last degree of prostration. This condition is denominated *ileus* or the *iliac passion*, and is frequently, though upon insufficient grounds, treated of as a distinct disease. It is the closing stage of the severest forms of colic, and is often connected with some irremovable mechanical obstruction. It may occur, in fact, in any case in which, no matter from what cause, whether spasm, or partial paralysis of the bowel, or obstruction, the alvine contents cannot find their way downward. Even ileus, however, is not always certainly fatal. Patients have, in numerous instances, recovered under apparently desperate circumstances; and hope and consequent efforts should never be abandoned, unless when some insuperable obstacle, such as scirrhous occlusion of the bowel, is known to exist.

Colic has no fixed duration, sometimes terminating in a few hours, and sometimes running on for two or three weeks.

Diagnosis.—The complaint with which colic is most likely to be confounded is strangulated hernia. In fact, the only difference between this and some forms of colic depending on mechanical obstruction is, that the former presents certain external characters by which it can be recognized, and may be relieved by the timely application of surgical means. But this distinction is of the highest importance, and the possible existence of strangulated hernia should be borne in mind, in every case of severe or obstinate colic, and a close examination instituted. Many lives have been lost from want of attention to this caution. From mucous enteritis colic may be distinguished by the constipation which attends it; from both this and peritonitis, by the more paroxysmal character of the pain, by the relief frequently derived from pressure, by the absence of fever, and by the restless movements of the patient.

Simple Spasmodic Colic.—The essential character of this variety is spasm of the bowel, unattended with any other necessary pathological condition. Constipation is here the result, and not the cause of the spasm. Attacks are most commonly brought on by indigestible food, especially flatulent vegetables, and are peculiarly apt to occur in dyspeptic persons. Under these circumstances, the disease is sometimes called *dyspeptic colic*. The presence of the undigested matters in the bowels occasions frequently a copious extrication of flatus, which increases the spasm by the stimulus of distension. Gases evolved from other causes sometimes produce attacks, without any irritant substance in the bowels. In either case, the disease is often called *flatulent colic*. The patient is affected with borborygmi, distension of the abdomen, and eructations of flatus, which are sometimes exceedingly copious, and usually afford more or less relief. When the attack is induced by indigestible food, or other irritant taken into the stomach, this organ is apt to participate in the spasm, and occasionally the symptoms are of the most violent character. The presence of irritant secretions in the bowels, or the retention of portions of hardened feces insufficient to obstruct the passage, may sometimes act as an exciting cause; but the irritation from these sources is more apt to fall upon the mucous coat than upon the muscular, and to produce diarrhœa or dysentery, than colic. This variety of colic is also frequently induced by cold, especially by cold feet, and sometimes results from rheumatic or gouty irritation acting upon the nervous tissue of the bowel, from suppressed discharges, repelled cutaneous eruptions, mental disturbance, and an hysterical state of the nervous system. In the last case, it has been called *hysterical colic*. To the same variety belongs also the intestinal spasm induced by worms, denominated by some *verminose colic*.

Simple spasmodic colic is very rarely fatal. Sometimes, however, it is so; and then large portions of the bowel are usually found, upon dissection, in a contracted state, while the portion above the stricture is distended, and marked more or less with appearances of inflammation, though not enough to account for the fatal issue. Death probably results from the spasmodic closure of the bowel, operating as an obstacle to the passage of the intestinal contents. It is probable that the great distension of the bowel, above the contracted portion, may in some measure paralyze the muscular coat, and thus act as an additional cause of the constipation.

Bilious Colic.—The peculiarity, in this form of colic, is the coincidence of derangement of the biliary organs with the intestinal spasm; the former being probably the source of that irritation which evinces itself in the latter. An attack of bilious colic is frequently preceded by loss of appetite, nausea, a feeling of lassitude or weariness, and other symptoms of disordered hepatic action. The paroxysms of pain are generally attended with much irritation of stomach, and vomiting of yellow or green bile, the discharge of which affords temporary relief. There is at the same time usually some sallowness of the skin, or a yellow tinge of the conjunctiva; the urine is often deep-coloured, and yellowish; and there is a yellowish-white fur on the tongue. Not unfrequently some tenderness will be found upon pressure in the epigastrium or right hypochondrium; and the pulse, though usually calm at first, is sometimes febrile from the beginning, and often becomes so, if the disease continues. There is also occasionally incomplete paralysis of some portion of the upper or lower extremities, with convulsive movements in different parts of the body. When stools are obtained, they are sometimes bilious, and sometimes light coloured, indicating a want or deficiency of bile. The immediate cause of the spasm is probably an irritation of the muscular coat of the bowels, induced either by sympathy with irritation of the liver, or by a congested state of the portal veins, or by both. The vomiting of bile does not necessarily indicate an increase of hepatic secretion; for the bilious matter may proceed from the gall-bladder, discharging its contents in consequence of the pressure upon it in the act of vomiting. Either an increase or diminution of bile may be a consequence of irritation of the liver, and an attendant upon portal congestion, and either may therefore occur in bilious colic. The original causes are probably the same as those which give rise to cholera morbus and bilious diarrhœa. Perhaps the most common is exposure to cold, after previous lengthened exposure to heat. Hence the disease occurs most frequently in hot weather, especially when the nights are cool; and is peculiarly prevalent in those regions where this alteration of temperature between the day and night is a usual event. It is probable, also, that miasmata are capable of producing colic by their influence upon the biliary organs.

Colic from Obstruction.—In this variety, the spasm of the bowel is the result of its accumulated contents, consequent upon a stoppage more or less complete of the passage. The constipation is here the cause, instead of being, as in the preceding cases, the effect of the spasm. The obstruction may depend upon accumulated and compacted feces, upon insoluble substances taken largely or repeatedly by the mouth and arrested in the bowels, upon invagination of the intestine, tumours, &c. Of these various causes, as well as of the diagnosis of obstruction in general, and of its varieties, I shall treat at large under the head of *obstruction of the bowels;* as it is this which constitutes the real disease, of which the colic is merely a symptom. It is sufficient here to say that, unless the impediment to the passage of the alimentary matters be removed, the complaint ends in death, preceded by all the symptoms of ileus.

Rheumatic or Inflammatory Colic.—Inflammation of the mucous or the peritoneal coat of the bowels, though almost always attended with spasmodic pain, is characterized by symptoms which strikingly distinguish it from colic. This, however, is not the case with inflammation of the muscular coat exclusively. It is true that this coat is seldom or never inflamed without more or less participation of one of the others, unless in cases of rheumatism or gout attacking the bowels. Hence, this variety of colic might emphatically be styled *rheumatic or gouty*, although these two affections may also be exhibited in the bowels in a merely neuralgic form, or in that of mucous inflammation or irritation. Rheumatism of the muscular tissue of the bowels is not very uncommon. It may be either original or translated. It may frequently be recognized by coming on immediately after the retrocession of rheumatism from some external part. A portion more or less extensive of the muscular coat becomes tender and painful, and either refuses altogether to contract under the stimulus of the alimentary or feculent matter, like an external muscle similarly affected, or is thrown into the most exquisitely painful, and at the same time inefficient efforts at contraction. The pain, in these cases, is more steady and uniform than in spasmodic colic; and, when paroxysms occur, they appear to depend upon the effort of the bowel to carry forward its contents by the ordinary peristaltic movement. Hence, purgatives produce occasionally severe pain during their operation. The constipation is a consequence of the insufficiency of the peristaltic action, and does not depend necessarily upon spasm; although a portion of the bowel, not affected to the point of inflammation, may sometimes be thrown into spasmodic contraction. There is often tenderness upon pressure, and sometimes fever. The pain is in general more circumscribed than in spasmodic colic, and purgatives do not afford the same relief. Within my observation, the ascending and descending colon have been the portions of bowel most commonly affected. Though exceedingly painful, and sometimes apparently threatening, this form of colic is very seldom fatal.

Neuralgic Colic.—*Neuralgia of the Bowels.—Nervous Colic.*—The bowels, like most other parts of the body, are subject to attacks of severe pain, without inflammation, or necessary vascular excitement. Such attacks, when complicated with spasm, belong to simple spasmodic colic. When not thus complicated they cannot be better designated than by the title at the head of this section. The pain, though somewhat paroxysmal, is usually more steady during a certain length of time than spasmodic colic. There is not the same frequent alternation of severe pain and comparative ease. As in the preceding variety, paroxysms are sometimes induced by the passage of alimentary matters and purgative medicines; and constipation is owing to the indisposition of the muscular coat to contract, in consequence of the pain which contraction induces; but there is less difficulty in procuring evacuations from the bowels than in most other forms of colic. The pain, during exacerbation, is not increased by pressure, although the bowel is afterwards left tender. The pulse is either at the standard of health, or beneath it. Sometimes the disease is distinctly intermittent, occurring at the same time every day or every other day, and, after having continued for some hours, leaving the patient quite easy in the interval. The causes of neuralgia of the bowels are not less obscure than those of the same affection elsewhere. Sometimes it depends on disorder in the spine, or in the ganglia of the sympathetic nerve, and sometimes appears to have its origin in general debility, or in a rheumatic or gouty diathesis. A form of colic closely resembling colica pictonum has been described under the name of nervous colic; but I believe that, in such cases, a very close scrutiny will generally detect the operation of some preparation of lead.

Lead Colic, Painters' Colic, or *Colica Pictonum*, is so peculiar both in its origin and character as to merit the rank of a distinct disease; and will therefore be treated of under a separate head.

laginous or farinaceous liquids. In the more advanced stages, milk, broths, and boiled meats, with fresh butter and cream, may be allowed; and, in diarrhœa of debility, this kind of food should be given from the commencement. In many chronic cases, an exclusive milk diet will often alone effect cures. The dietetic rules applicable to dyspepsia should be observed during convalescence. (See *Dyspepsia.*)

2. COLIC.

Colic (from κωλον, *colon*, or κοιλια, *the belly*) is characterized by pain in the bowels, usually more or less paroxysmal in its character, associated with constipation, and occurring independently of inflammation either of the mucous or peritoneal coat. Pathological conditions essentially different are included in the above definition; but there is a convenience in considering them together; as their most prominent symptoms are the same, and their treatment similar. I shall first give the symptoms of colic in general, and then treat of the varieties of the disease, so far as they are peculiar.

Symptoms.—The pain of colic occurs usually in frequently returning paroxysms, with irregular remissions or intermissions; but, in some instances, is continued and almost uniform for considerable periods. During the exacerbation, it is often exceedingly severe, so as to cause even persons of fortitude to groan or cry out. It occurs most commonly about the umbilicus, though not unfrequently in other parts, and sometimes over the whole abdomen. It is described as twisting, rending, pinching, &c., and is often attended with a feeling of spasmodic constriction. The patient is for the most part extremely restless, frequently changing his position, turning from one side to the other, sitting up in bed, or rising and walking about the room with his body bent, and his hands frequently pressed against the abdomen. The muscles of the abdomen are sometimes spasmodically contracted, either in knots, or so as to produce a general rigidity of the anterior parietes. The violence of the pain occasionally depresses temporarily all the vital actions, producing paleness of the skin, cold sweats, a shrunken countenance, and a feeble pulse. When very sudden in its attack, it may produce faintness, and even temporary insensibility, and in infants frequently occasions general convulsions. It is often relieved by pressure on the abdomen, but not uniformly so. When the violent pain has ceased, a feeling of soreness is generally left behind.

The pain, in true colic, is always accompanied with constipation, either as cause or effect; and, when this is overcome by medicines, not unfrequently ceases. In certain cases, however, it continues without abatement, notwithstanding the operation of cathartics.

Along with the pain and constipation there is often vomiting, but this is by no means constantly present. The stomach occasionally participates with the bowels in the spasmodic pain. The pulse is generally either healthy, or somewhat depressed. Occasionally, however, the disease is originally associated with inflammation, or this condition ensues in the course of it, or there is high irritation in some neighbouring organ. Under these circumstances, a febrile condition may be developed.

Colic, in the great majority of cases, yields readily to suitable treatment. In some instances, however, the constipation persists, and the disease assumes the most alarming character, in spite of all that can be done. The vomiting is now frequent, everything taken into the stomach is rejected, the action of the bowels themselves is inverted, and even feculent matter is discharged from the mouth. Along with these symptoms are a swollen, tense, and tympanitic abdomen, hiccough, great anxiety, cold sweats, a feeble pulse, and a general others adapted to these cases. A fluidounce of the oil with twenty-five or thirty drops of laudanum, given in peppermint water, will very often effectively meet all the indications.

At the same time, external means should not be neglected. Strong friction over the abdomen sometimes proves serviceable by the expulsion of flatus. Warm fomentations, anodyne and emollient cataplasms, and, in urgent cases, hot oil of turpentine applied by means of a folded flannel moistened with it, or a large sinapism over the abdomen, may also be employed.

When the pain arises from irritating matter in the stomach, which may be inferred to be the case if the attack commence soon after eating, or if the patient be affected with nausea or retching in the intervals of the spasm, full vomiting should be promptly induced, either by copious draughts of warm water or warm chamomile tea, or by a dose of ipecacuanha. The most violent cases sometimes yield immediately to this simple remedy, after powerful anodynes and stimulants have been employed without effect. The attention of the young practitioner cannot be too strongly directed to this fact.

If there be reason to suppose that undigested food, acrid secretions, feculent accumulations, or any other irritating substance in the bowels, are the cause of the spasm, the indication for alvine evacuations is still stronger than in other cases, and this should be kept prominently in view. Should castor oil not act speedily, or be rejected from the stomach, recourse may be had to sulphate of magnesia; to infusion of senna with Epsom salt, manna, and fennelseed, cardamom, or ginger; or, in very obstinate cases, to croton oil, of which from half a drop to two drops may be given, and repeated at short intervals until it operates, or produces some obvious inconvenience. When the stomach is very irritable, calomel is often preferable to other cathartics, being retained when almost everything else is rejected. Five grains may be given every two, three, or four hours until it operates, or the whole quantity amounts to twenty grains. The occurrence of salivation will, under such circumstances, in persons of ordinary constitution, be of no disadvantage. The most obstinate cases sometimes yield immediately after the mouth has become sore. If the irritating matter in the stomach or bowels be acid, magnesia should either be substituted for the other cathartics, or given in conjunction with them; and it has been observed that mild laxatives of this character sometimes operate, when more powerful purgatives serve merely to increase the spasmodic constriction, and to provoke vomiting. A good laxative mixture for the purpose consists of magnesia and manna, mixed with strong fennelseed tea.

To hasten the action of the cathartics, or to supply their place when they are rejected from the stomach, or from other cause fail to operate, purgative enemata are of the utmost importance. Indeed, in some very bad cases, they constitute our chief reliance. The milder should be first employed, and afterwards if necessary, the more powerful, their strength being increased at each successive repetition. After failure with the common injection, consisting of olive oil or lard, common salt, and molasses, of each a tablespoonful, mixed with a pint of warm water, the operator may resort successively to castor oil, infusion of senna, jalap, extract of colocynth, &c., each in three or four times the quantity usually given by the mouth, and diluted with water so as to measure a pint or more. Oil of turpentine, in the quantity of from half a fluidounce to two fluidounces, mixed with half a pint or a pint of water by the intervention of the yolk of eggs, forms an excellent enema in severe cases. When the spasm is dependent on flatulence, or connected with hysterical disorder, the greatest advantage may be expected from a drachm of assafetida rubbed up with water. In cases of ileus, where danger is imminent, the more or less with appearances of inflammation, though not enough to account for the fatal issue. Death probably results from the spasmodic closure of the bowel, operating as an obstacle to the passage of the intestinal contents. It is probable that the great distension of the bowel, above the contracted portion, may in some measure paralyze the muscular coat, and thus act as an additional cause of the constipation.

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Rheumatic or Inflammatory Colic.—Inflammation of the mucous or the peritoneal coat of the bowels, though almost always attended with spasmodic pain, is characterized by symptoms which strikingly distinguish it salts, &c. I usually direct four grains of opium, with from eight to twelve grains of calomel, to be made into four pills, two of which are to be taken immediately, and the others at intervals of an hour, if required. The operation of the cathartics should be assisted by enemata; and recourse should be had to the various measures already enumerated, as calculated to facilitate the opening of the bowels. The remarks before made in relation to external remedies, such as warm fomentations, sinapisms, blisters, the warm bath, &c., are equally applicable here; and the necessity is still greater for guarding against, or correcting inflammation, by general and local depletion. Calomel is much more strongly indicated than in the simple spasmodic colic; and, if the quantity at first exhibited, as above directed, should fail to effect a cure, the medicine may be administered with tolerable freedom throughout the complaint. Indeed, in obstinate cases, it is almost always desirable to push the mercurial to a moderate salivation, for which purpose a grain or two may be given at regular intervals, varying according to the urgency of the symptoms. The same cautions are requisite here as already given, in relation to the maintenance of a free state of the bowels, and the proper regulation of the diet, during convalescence. Especial care should be taken to avoid exposure to changes of temperature, until convalescence is firmly established. Should the fecal discharges remain clay-coloured, an alterative course of mercury, or nitromuriatic acid may be employed, and the various means resorted to, calculated to restore the function of the liver to its healthy state. (See *Jaundice.*)

Rheumatic or *inflammatory colic* usually presents stronger indications for general and local bleeding than either of the other forms of the disease. In almost all cases, where the constitution of the patient is tolerably robust, the lancet may be advantageously employed with great freedom. Cups or leeches may also be liberally applied along the course of the affected bowel, which is generally marked by exhibiting more or less tenderness upon pressure. It is desirable to evacuate the bowels at first freely; but this should be accomplished if possible by the milder cathartics, such as castor oil or Epsom salt, aided if necessary by enemata, rather than by those of a very active or drastic character, as the portion of the bowel affected becomes exceedingly painful, under the stimulus of active purgation. After the bowels have been well opened, and the pulse sufficiently reduced by the loss of blood, objects which in general may be very soon effected, the patient should be put under the influence of opium, which may be very advantageously combined with ipecacuanha and calomel. One or two grains of opium, with an equal quantity of ipecacuanha, and from two to four grains of calomel, may be given at bedtime, and the combination may be repeated, if necessary, at intervals of four, six, or eight hours, so as to keep the patient in tolerable ease, and to sustain a steady perspiration; the plan of treatment being occasionally intermitted, in the day, for the administration of a mild cathartic. Should the mouth exhibit the slightest evidence of a general mercurial influence, the calomel should be suspended. Upon the commencement of such an influence, the symptoms of the disease very generally give way. Should the stomach be irritable, as sometimes happens, the calomel and opium may be given without the ipecacuanha; or the whole may be suspended until the irritability has yielded to anodyne enemata, and to external applications calculated to relieve it. (See *Vomiting*, page 564.) When it is desirable, upon any account, to avoid the possibility of salivation, the calomel must be omitted, and either the opium and ipecacuanha employed alone, or their place supplied by a mixture of an opiate with some preparation of colchicum. I have been in the habit of using the officinal solution of sulphate of morphia, in the dose of one or two fluidrachms, with from twenty to forty drops of the wine of colchicum root, repeated every four, six, or eight hours. It has appeared to me that this combination is especially applicable to cases in which the irritation is of a somewhat fugitive and unsettled character, and liable to ready translation to other, and perhaps still more delicate organs. The remarks already made, in relation to local external remedies, and the use of the warm or hot bath, in simple spasmodic colic, are equally applicable to this variety. Revulsion to the extremities is also indicated; and hot and stimulating pediluvia, with sinapisms to the feet and ankles, may be employed. Occasionally cases occur in which the general actions are so feeble as not to admit of depletion. If, along with this debility, there should be a disposition to sweat during sleep, sulphate of quinia will be likely not only to support the strength of the patient, but also to cure the disease.

In *neuralgia of the bowels*, the same indications exist as in the other forms of colic, for relieving pain, and procuring alvine evacuations. The former indication requires the use of opiates, the latter of mild cathartics, which are usually sufficient for the end. But the same relief is not obtained after the cathartic action, as in ordinary colic. Other remedies must be employed for the cure of the affection. Of these the preparations of colchicum, given as largely and as frequently as can be well borne by the stomach, are perhaps the most effectual. Good may also be expected from the narcotic extracts, as those of belladonna, stramonium, conium, and hyoscyamus, which may be given alone or in combination, and pushed so far as to produce their peculiar impression upon the brain. It is possible that the chalybeates, and other mineral tonics, may also prove serviceable, although I have little experience with them in this form of neuralgia. Alum has been found very useful in certain cases of nervous colic, closely simulating, if not identical with colica pictonum. Should the affection assume the regular intermittent form, it will be almost certainly cured by the free employment of sulphate of quinia; and this medicine may be used, with some hope of advantage, in the remittent and even continued cases. The same external remedies may be applied as in ordinary colic, with the addition of frictions with strong tincture of aconite, or ointment of veratria. Should tenderness upon pressure be observed in any portion of the spinal column, cups or leeches, with subsequent rubefaction, vesication, or pustulation of the part affected, will be required. Bleeding seldom does good, but on the contrary often much injury in this affection. The diet should be digestible and nutritious without being stimulant.

3. LEAD COLIC.

Syn.—Painters' Colic.—Colica Pictonum.

This disease has been called *saturnine colic* and *metallic colic*, from its cause, *painters' colic* from a class of persons very subject to it, and *Devonshire colic* and *colica Pictonum*, the former from the county of Devonshire, in England, the latter from the province of Poitou, in France, in both of which districts of country it has prevailed.

It usually commences with symptoms not unlike those of dyspepsia, as diminution or loss of appetite, epigastric uneasiness, slight and fugitive abdominal pains, a disposition to costiveness, with general languor and depression of spirits. These symptoms continue for several days, gradually augmenting, until the patient is at length generally compelled by the severity of his pains to abandon his customary avocations, and betake himself to his bed. In some instances, however, the attack is sudden, and without premonition.

The pain is felt more especially about the umbilicus, or in the spinal region, but usually extends also in a greater or less degree over the abdomen, and sometimes shoots up into the chest and downwards into the pelvis. It is excessively severe, being described as tearing, rending, boring, &c., and is attended, moreover, with a feeling of indescribable wretchedness, which is forcibly expressed upon the countenance. Though paroxysmal, it is seldom entirely absent, unless momentarily after vomiting, which sometimes appears to afford relief. In the remission, however, there is rather a feeling of constriction and vague uneasiness than of acute pain. The patient finds it impossible to remain long in one position; sometimes rising, and walking about the chamber, and again resuming his bed; now turning upon one side, then on the other, getting upon his knees, or lying upon his face, and assuming the most grotesque postures, often with his body bent almost double, and his hands pressing together upon his abdomen. The suffering is so exquisite as to extort groans from individuals of the greatest fortitude, and I have known a strong man to cry like a child. To an experienced eye, the expression of extreme wretchedness upon the countenance, in connexion with the whimsical movements of the patient, is sometimes alone sufficient to mark the complaint. The paroxysms are often worse during the night, and the patient is unable to sleep. Moderate pressure upon the abdomen does not in general aggravate the pain, but, on the contrary, often yields partial relief. Some uneasiness, however, is occasionally felt, in particular spots, when they are strongly pressed. The belly is in most cases somewhat retracted, especially at the umbilicus, and the abdominal muscles are hard, and often gathered into knots. The testicles are apt to be drawn up during the paroxysm; and a severe irritation is sometimes extended to the urinary passages and rectum, producing strangury and tenesmus.

Obstinate constipation, sometimes resisting the most active cathartics, and often attended with a desire to go to stool, and a feeling as if an evacuation would afford ease, is one of the most characteristic features of the disease. When evacuations are obtained, the feculent matter first discharged is usually in small, hard, dark-coloured, knotty lumps, sometimes covered with mucus. It is said that the sphincter ani is in some instances so violently constricted as to resist the introduction of a pipe.

Nausea and vomiting are very frequent, and the matter discharged is generally bilious. Indeed, irritability of stomach is one of the most distressing circumstances of the disease, and sometimes interferes greatly with the efficacy of the medicines administered. Occasionally it is among the first signs of the action of the poison.

The tongue is flabby, pale, and often tremulous when protruded; the breath sometimes fetid; the urine scanty; the pulse usually slow and hard, but occasionally frequent; the face of a pale, dingy, or sallow aspect; the hand tremulous, with great weakness at the joint of the wrist; the lower extremities affected with painful cramps; and the muscles of the chest sometimes spasmodically contracted, with pains like those of angina pectoris, and palpitation of the heart. As first noticed by Dr. Burton, the gums present, especially at their margin, a pale, bluish-gray colour, characteristic of the action of lead upon the system.

The complaint is sometimes attended with evidences of inflammation in the abdominal viscera; such as tenderness upon pressure, a hot dry skin, frequent pulse, and a general febrile condition. Delirium, convulsions, and paralysis are also among its occasional complications. The palsy may affect only the muscles, or it may extend also to the sensorial functions, involving the senses of touch, sight, and hearing. It is, however, more frequently a consequence than an accompaniment of the colic.

The symptoms usually continue unabated for several days, and then gradually subside; and this result will take place, in the great majority of cases, though little or no treatment be employed. The severity of the complaint, however, may be diminished, its duration abridged, and its very unpleasant sequelæ in great measure prevented by appropriate remedies; and there can be no doubt that cures may be effected in cases which would prove fatal, if left without aid. Under proper treatment, the proportion of deaths is very small. Of 3569 cases treated by different physicians in Paris, 95 died, or about 2.7 per cent.; and, according to Andral, of more than 500 persons treated during eight years in the hospital *la Charité* by M. Lerminier, only 5 died, or less than 1 per cent. (*Dict. de Méd.*, viii. 388.) The disease usually yields to appropriate remedies in less than a week; and, when it proves fatal, does so as a general rule in consequence of some unfortunate complication, arising from the peculiar susceptibility of the patient, or the intense action of the cause. The cases attended with epileptic convulsions almost all end unfavourably. Sometimes headache, delirium, and coma supervene, and the patient dies apoplectic. In other cases, a general failure of the nervous power takes place, the violent pains cease, dyspnœa occurs, the skin becomes cold and pale, the pulse feeble, the countenance shrunk, sight and hearing impaired, and a fatal asphyxia closes the scene. In some rare instances, death appears to result directly from the morbid state of the abdomen, and the symptoms preceding the fatal issue indicate mortification of the bowels, or intense inflammation.

Patients before a perfect cure are liable to relapse, and, after one attack, are much more susceptible to the disease than before, so that a slight exposure to the cause frequently induces a return. By repeated exposure, or by the long continued but slight action of the cause, a state of chronic disease at length ensues, which is often difficult to manage, and sometimes bids defiance to medicines, either terminating fatally in a few weeks or months, or producing a train of complicated evils, which run through long years of suffering. Among the characters of this morbid condition are palsy of the extremities, especially of the forearms, and occasionally also of the voluntary muscles of other parts; defective nutrition and consequent general emaciation; enfeebled capillary circulation, with a pale, sallow, or dingy skin; œdema of the extremities gradually extending upwards; abdominal dropsy, and effusion in the pleura or pericardium; and general failure of the sensorial functions, indicated by defective touch, impaired hearing and vision, epilepsy, mania, and mental imbecility.

The *diagnosis* of lead colic is not difficult. It can scarcely be confounded with any other disease than one of the varieties of colic already described, from all of which it differs in the peculiar aspect, grotesque motions, and excessive restlessness of the patient, the incomplete remission of the pain, the retracted abdomen with its hard and knotty parietes, the spasmodic pains in the extremities, and the occasional paralytic complications.

On examination after death, constriction of portions of the bowels, particularly of the colon, has been observed, so great in some places as scarcely to admit the passage of a crow's quill. It is asserted that, in some instances, the stomach and intestines have been found in a state of preternatural contraction throughout their whole extent. Marks of inflammation, and even disorganization, of portions of the alimentary mucous membrane have also been noticed. In the United States army report of 1827, a case is given in which the arch of the colon was mortified "all around" to the extent of "five fingers' breadth," and six lines below was a stricture of the intestine. (Forry, *Am. Journ. of Med. Sci.*, N. S., iii. 321.) But these appear to have been accidental complications, and not essential results or attendants of the disease; for of eight cases reported by Andral in his *Clinique Médicale* (3e ed., ii. 110), only one presented constriction of the intestines, and, though slight marks of inflammation were observed in several, the intestinal canal was entirely sound in others; and in none were lesions discovered sufficient to explain the symptoms. In a case reported by Louis, the alimentary canal exhibited no mark of disease whatever. (*Recherch. Anat. Patholog.*, &c., p. 483.) Several others have obtained similar results from their post-mortem examinations. (*Dict. de Méd.*, viii. 389.) In cases of death from epilepsy supervening upon colica pictonum, hypertrophy of the brain has been found in some instances, softening of the brain or spinal marrow in others, while in others again no discoverable lesion existed in any of the nervous centres. (*Ibid.*, p. 385.) The inference to be drawn from these facts is, that the morbid cause acts directly upon the nervous system, and that any organic derangement, which may be detected after death, is merely an incidental occurrence, not constituting an essential part of the disease.

Cause.—Lead, admitted into the system, is probably the sole cause of colica pictonum. Hence, painters, glaziers, plumbers, potters, lead-miners, and manufacturers of white-lead and red-lead, are frequent subjects of the disease. Any preparation of the metal capable of finding an entrance into the circulation may produce the effect; but the vapours of melted lead, and the carbonate of its protoxide are the most frequent agents, probably because the greatest number of persons are exposed to their action. No matter by what avenue the poison enters the system, the effect is the same. Proof is not wanting that lead colic has resulted from the external use of the solution of subacetate of lead, especially when applied to the skin with an imperfect state of the cuticle. (*Trans. of Lond. Col. of Phys.*, iii. 435.) Innumerable observations have shown that various preparations of the metal produce the effect when taken into the stomach. Acetate of lead given as a medicine; water which has long stood in leaden reservoirs; cider and wines which have either been introduced into leaden vats, or been impregnated with the metal by means of litharge employed to sweeten them; carbonic acid water drawn from the fountain through leaden pipes, in which it had been permitted to stand; acidulous food kept in vessels glazed with lead; these, and various other forms in which the poison enters the stomach with medicine, food, or drink, have been abundant sources of the disease. The prevalence of colica pictonum among painters and manufacturers of white-lead, is ascribed by some to the uncleanly habits of the workmen, in consequence of which the carbonate, adhering to their hands and clothing, finds access to the stomach along with their food; and it is asserted that the disease has been rendered less prevalent among these individuals, by increased attention to cleanliness in their persons and dress. But even the most guarded care in this respect is not sufficient to ward off the disease; as the poison enters the system by the lungs even more readily than by the skin or stomach. Hence the great liability to the disease of those who work in the melted metal. It is stated that, in white-lead factories, where the practice of grinding the paint under water has been adopted, and the escape of the dry carbonate into the air thus prevented, the disease has become much less frequent. Painters are said to be most liable to be affected when shut up in close apartments, or in those heated in order more rapidly to dry the paint; and, according to Gendrin, they who use only fixed oil as the vehicle of the white lead almost always escape, while others who employ the oil of turpentine for the same purpose very frequently suffer.

The complaint has been ascribed to other causes. Thus, it has been sometimes considered epidemic, from its great prevalence in certain districts; but a local cause has generally been discovered, as in Devonshire and Poitou, in the use of cider or wine kept in leaden vessels, or purposely impregnated with litharge. Besides, it is highly probable that the bilious colic, which sometimes resembles it closely, has been mistaken for it. Another cause has been found by some in the use of acidulous drinks and food, and crude articles of diet; but the strong probability is, that when the disease apparently resulting from such causes has really been the one under consideration, and not simple spasmodic colic, it has arisen from some unsuspected impregnation of the article used with a salt of lead. When a disease having the characters of colica pictonum occurs, attention should always be directed to the discovery of some possible source of this poison. In a garrison of U. S. soldiers, at Fort Delaware, numerous violent cases of the disease occurred, which were found to be owing to the use of water collected in cisterns from a large painted roof. (*Am. Journ. Med. Sci.*, N. S., iii. 319.) The constitutional susceptibility to the poisonous action of lead is exceedingly different in different individuals; some escaping under precisely the same circumstances as those under which others suffer; and one being attacked only once or twice in his life, while another is subject to the disease upon every fresh exposure. Women are much less frequently affected than men, probably owing to the circumstance, that they are much less exposed to the cause. The greater prevalence of the disease at certain seasons, which has been observed by some, is ascribable to the greater activity, during these seasons, of those occupations which give occasion for its attack. Inferior animals in the vicinity of white-lead factories, are said to suffer in a similar manner with man.

It is probable that lead operates as a poison by an immediate influence upon the nervous matter, wherever it may meet with it, diminishing and ultimately destroying the motor power, as well as the property of receiving and conveying impressions, and that it does not produce its local effects, at least primarily, through an influence upon the nervous centres. On the contrary, the cerebral derangement is often the last in the succession of its effects. Its action upon the external muscles appears to be identical with that which it exerts upon the muscular coat of the bowels, which may be considered, in the lead colic, as in a state of partial paralysis. The violent neuralgic pains afford one out of numerous examples of this kind of derangement, attendant upon a depressed condition of the nervous power. The disorganization which is occasionally observed, in fatal cases, may, without violence, be referred to some incidental cause, or be considered as a mere result of the pre-existing nervous disorder. Some of the phenomena attendant upon the action of lead, such as the dryness of the alimentary mucous membrane, and the general deficiency of secretion, are ascribable to a stimulant influence upon the organic contractility, in other words an astringency, which is associated with the sedative power of its preparations, and is perhaps the most prominent of their therapeutical properties.

Treatment.—This is one of the complaints which, in the great majority of cases, get well spontaneously, and in which various modes of practice have acquired some repute, from the mere circumstance that they have been employed without proving an obstacle to the favourable course of nature. Nevertheless, there are remedies which are capable of producing a positive impression upon the complaint, of relieving it sooner and more effectually than nature would do unaided, and of counteracting its tendency to leave paralysis, and other serious derangements of health behind it.

The plan of treatment which has been generally pursued in this country, and which in my hands has almost invariably proved successful, consists of a combination of opiates and purgatives, and a resort to the constitutional impression of mercury in rebellious cases. Mercury appears to exercise a specific controlling influence over the poison of lead; but, as its operation if pushed too far is very inconvenient, and, as in so severe a disease it cannot always be used with that caution which would secure only a slight impression on the mouth, it is best in ordinary cases to attempt the cure without a salivation, and to resort to this measure only under urgent and threatening circumstances.

Two grains of opium may be given at once with from five to fifteen grains of calomel, to be followed in a few hours by castor oil, sulphate of magnesia, infusion of senna, croton oil, or some other active cathartic which the stomach may be best able to support; and cathartics should be repeated daily until the bowels are evacuated. The auxiliary employment of injections, as described under colic (*page* 624), may also be resorted to; and some advantage may be expected from fomentations, anodyne and emollient cataplasms, and rubefacients to the abdomen, and from the warm bath, though these remedies are less efficacious than in ordinary colic. The opiate should in general be repeated every night, in such quantities as may be necessary to alleviate the sufferings of the patient, and procure some sleep; being combined or not combined with calomel, according as the object may be to produce or not to produce the mercurial action. An anodyne enema containing a fluidrachm of laudanum may be substituted for opium by the mouth, when the stomach is very irritable; or the sulphate or acetate of morphia, in the quantity of a grain, may be sprinkled upon a small blistered surface in the epigastrium, under the same circumstances. This latter mode of relieving pain, and quieting irritability of stomach, may also be advantageously employed during the day, while efforts are made to evacuate the bowels by cathartics. Indeed, the internal use of opium is not incompatible with that of cathartic medicines, but sometimes favours their action by relaxing the spasm which resists it; and the two remedies may therefore be employed conjointly throughout the complaint.

When the symptoms are unusually urgent, or the case unusually obstinate, calomel and opium may be given together, in the quantity of two grains of the former and half a grain of the latter every two hours, or in equivalent doses at longer intervals, and steadily persevered in, until the gums become somewhat sore. Upon the occurrence of this event, the symptoms are in general greatly relieved, and cathartics which may have before failed will readily operate.

If the pulse should be accelerated, febrile symptoms developed, and the belly painful on pressure, indicating the probable existence of inflammation, blood should be taken freely from the arm, and cups or leeches, followed by an emollient poultice or a blister, should be applied to the abdomen. It is said that, when points of tenderness have been discovered under strong pressure, leeches applied directly to these points have afforded much relief. Should delirium or convulsions occur, it will be advisable to employ general bleeding, sinapisms or blisters to the extremities, and cups or leeches with cold to the head, while we are going on with the use of purgatives. But, in the ordinary cases of colica pictonum, the loss of blood is not required.

When paralytic symptoms remain after the cure of the colic, if the patient has not been already salivated, he may now be put under a moderate mercurial impression, as one of the most effectual remedies for this disorder. The daily use of the warm bath, with blisters to the part affected or to the spine, will be found useful auxiliaries. Nux vomica, and the nitrate of silver in the dose of half a grain three times a day, united with a little opium and gradually increased, have also been recommended; and alum, or iodide of potassium, if not previously used, may now be tried as a substitute for the mercury, or in conjunction with it. Care should be taken to keep the bowels regularly open, and sulphur if necessary may be employed for this purpose.

Before dismissing the subject of the treatment of colica pictonum, it will be proper to give a brief account of other plans or remedies which have attracted attention. The great success of the treatment known in France as that of the *Hôpital de la Charité*, claims for it a particular notice. According to this plan, the patient is put upon a certain course of treatment, each day of the disease having its appropriate combination of medicines, without reference to the peculiarities of the case. The plan essentially is to vomit in the early stage, to purge daily afterwards, and to administer at night an opiate by the mouth, and wine by enema. With the exception of the emetic, the treatment is founded upon the same principles with that already detailed, viz., the concurrent use of anodynes and purgatives.[*]

Some have treated the disease with purgatives chiefly or exclusively, and croton oil has been especially recommended; others, with opiates; but, though the patients have generally recovered, the cure is neither so speedy nor satisfactory as when the two are combined.

By the school of Broussais the complaint was considered as gastro-enteritis, and treated with bleeding, repeated leeching, warm fomentations, baths, emollient injections, and diluent drinks. Great success was claimed for this mode of management; but general opinion has not decided in its favour.

Alum has been very highly praised as a remedy for colica pictonum, and is asserted to have procured relief where all the usual remedies have failed. It has long been employed by various German and French practitioners. M. Montanceix asserts that, given in the quantity of three or four drachms in the twenty-four hours, it uniformly cures the disease in the course of six or seven days (*Arch. Gén. de Méd.*, xviii. 370); and M. Gendrin has seen it employed in fifty-eight well marked cases without a single failure. (*Trans. Med.*, vii. 62.) I have employed it in two cases which had resisted mercurial treatment, with the effect of producing a prompt cure. Dr. Eberle obtained the happiest effects from a combination of alum and opium, given in the dose of twenty grains of the former and one grain of the latter every three hours, after calomel with opium pushed to salivation, and active purgation had been employed in vain. M. Brachet, of Lyons, author of a prize essay on lead colic, and experienced in the treatment of the disease, though he employs purgatives and opiates, considers alum as the most valuable remedy. The quantity administered should generally not exceed two or three drachms in twenty-four hours; as beyond this amount it would be very liable to irritate the stomach. With my present experience in relation to this medicine, I should be disposed to employ it preferably to mercury, at least in all chronic cases, and only to have recourse to the latter remedy, when the alum had failed.

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[*] The following sketch of this rather empirical plan is taken from the *Dictionnaire de Médecine:*—*First day*, a pint of infusion of cassia fistula (℥j to Oj), with three grains of tartar emetic, and from four to eight drachms of Epsom salt.—*Second day*, six grains of tartar emetic in eight ounces of water, at two doses, with an interval of ten minutes.—*Third day*, two or three glasses of a laxative and sudorific drink, consisting of a "decoction of the four sudorific woods," (guaiacum wood, sarsaparilla, china root, and sassafras root,) in which from four to six drachms of senna have been infused.—*Fourth day*, a purgative potion consisting of six ounces of infusion of senna, one ounce of the electuary *diaphœnix* (an officinal of the French codex, containing demulcents and aromatics with scammony), from a scruple to a drachm of jalap in powder, and an ounce of syrup of buckthorn.—*Fifth day*, as the third.—*Sixth day*, as the fourth. Every day, during the treatment, a pint of "decoction of the four sudorific woods" is to be taken for ordinary drink; and every evening an injection is to be administered, containing twelve ounces of red wine and four ounces of the oil of walnuts, to be followed by half a drachm of *theriac* (a French officinal consisting of about seventy ingredients, and containing about a grain of opium, which is the chief ingredient, in a drachm), with one or two grains of opium. At noon every day, or upon those days when no purgative is taken, a cathartic enema is to be administered, composed like the purgative potion above mentioned, except that it contains a pound instead of six ounces of the infusion of senna. If the pains still remain at the end of six days, the treatment is continued by giving on alternate days the laxative sudorific drink, and the purgative potion above mentioned. The cure is considered complete when all pain has ceased, and constipation has not returned for five or six days after the disuse of purgatives. During the treatment a strict diet is observed; but the patient is afterwards allowed to eat freely.

Ascribing the influence of alum, in the cure of colica pictonum, to its chemical action in converting the poisonous compound of lead which may have entered the system into the insoluble and probably inert sulphate of that metal, M. Gendrin was induced to try the effects of sulphuric acid alone, and found this remedy not less successful. He states that he has employed the acid in more than three hundred cases, and uniformly with success. From a drachm to a drachm and a half of sulphuric acid, mixed with three or four pints of water, was given daily. (*Dict. de Méd.*, viii. 395.) Whatever may be thought of the results, the explanation is, I think, more than doubtful. If alum and sulphuric acid are capable of curing painters' colic, it is by some other mode of action than by following the salt of lead in its course through the system, and changing it wherever overtaken into the sulphate.

Iodide of potassium has been introduced to the notice of the profession by M. Melsens as a remedy in lead poisoning; and others have since employed it with very encouraging success. Its use was suggested on the ground of its probable chemical agency in eliminating the poison from the system. As iodide of potassium has the property of dissolving the salts of lead, it was supposed that it might render soluble in the blood any compound of lead deposited in the tissues, and thus enable it to be discharged by some one of the emunctories. Recent observations have tended to confirm this view of its action; as, in several cases of saturnine poisoning, in which no lead could be detected in the urine before the employment of the iodide, it was found in that secretion after the system had been placed for a short time under the use of the medicine.* It may be given in the dose of from five to twenty grains three times a day, and should be long persevered with in obstinate cases.

M. Malherbe employs belladonna in the treatment of this disease, and generally relieves his patients on or before the third day. (See *Braithwaite's Retrospect*, Am. ed., xxiv. 116.) Dr. Swett, of New York, states that strychnia, in the dose of one-sixteenth of a grain three times a day, usually gives relief in forty-eight hours. (*N. York Med. Times*, ii. 352.) Dr. Graves recommends tobacco fomentations to the abdomen, continued until the peculiar effects of the narcotic are experienced, and then followed by cathartics. (*Dublin Hospital Reports*, vol. iv.) Dr. Aran employs chloroform, both internally and externally, with great advantage in relieving pain and relaxing spasm. (See *Am. J. of Med. Sci.*, N. S., xxi. 484.) Dr. Odier, of Geneva, combines valerian and cold baths with purgatives. (*Dict. de Méd.*, viii. 396.) Dr. Wilson, physician to the Middlesex (London) Hospital, has employed with success enemata and the hot bath simultaneously, the former being administered while the patient is in the latter. (*Med. Exam.*, iv. 488, from the *London Lancet.*) Vinegar diluted with water, and taken as a drink, is said to have effected a speedy cure after the failure of other means. (*Phil. Journ. of Med. and Phys. Sci.*, xii. 172.) MM. Chevallier and Rayer gave hydrosulphuric acid in several cases with supposed advantage. (*Bullet. des Sci. Méd.*, Dec. 1827.)

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* See upon this subject a paper by Dr. F. A. Parkes, of London, in the *British and Foreign Medico-Chirurg. Rev.* for April, 1853 (Am. ed., p. 410); and another by Dr. H. S. Swift, of New York, in the *New York Med. Times* (iii. 145), where several interesting cases are detailed in which the iodide of potassium was employed with complete success.

The diet, throughout the treatment, should be light and easily digested, consisting of farinaceous substances with weak animal broths, when these are not contraindicated by the existence of inflammation. Care should be taken, even after recovery, to avoid flatulent, acescent, and indigestible food, until the stomach and bowels have entirely recovered their powers. Exposure to a cold damp atmosphere should also be avoided, and flannel should be worn next the skin. When an individual has shown himself, by successive attacks, to be peculiarly susceptible to the poisonous influence of lead, nothing remains for him but to abandon the business which has exposed him to this influence.

Prophylactic measures are of some importance in guarding against the poison of lead. Frequent washing of the hands and of the whole person, and a change of clothes upon leaving off work; care not to apply the hands, when soiled with white lead, to the mouth; sleeping at a distance from the works; free ventilation of the apartments; and the grinding of the white lead under water, are all measures calculated to diminish the chances of an attack. M. Gendrin recommends the internal and external use of sulphuric acid, largely diluted with water; and it is possible that this may have some effect so far as regards the poison introduced into the stomach, or applied to the skin; but it is difficult to perceive how it could prevent the action of lead inhaled into the lungs. Besides, the continued use of so active a substance might itself lead to serious derangements of health. Not much more, probably, can with justice be said of the prophylactic virtues of fats and fixed oils, as articles of diet; though the use of two ounces of olive oil, every morning, is said to have proved efficacious in warding off the disease.

Article IV.

CONSTIPATION.

By this term is indicated a condition of the bowels in which the stools are less frequent or less in quantity than in health. Cases in which the intestines are entirely closed against the passage of feces, in consequence of some mechanical impediment, are treated of under the head of obstruction.

Symptoms.—In deciding as to the existence of constipation in any particular case, it is necessary to take into consideration the interval at which the alvine evacuations habitually occur, in the healthy state of the individual. Most persons have one passage in each period of twenty-four hours; but some have two or more daily, others only one every third or fourth day; and instances are occasionally met with, in which the interval is extended to one or even two weeks, without apparent disadvantage. It is probable, however, that, in these latter cases, a close examination would discover derangements, sufficient to prove that the long suspension of the evacuations was anything but a healthy state of the function. In general, constipation may be said to exist when the passages occur less frequently than once a day. But a person may be very seriously constipated, notwithstanding that his evacuations are quite regular in the period of their recurrence, if they be of insufficient quantity. It not unfrequently happens that a portion of the feculent matter which ought to be discharged at each stool is retained, and an accumulation thus insensibly takes place, which at length becomes manifest by the great inconvenience it occasions.

The feces in constipation are usually harder and dryer than in health, and not unfrequently come away in knotty lumps, with much straining, and painful distension of the anus. These lumps are occasionally covered with a white or bloody mucus, and are of different colour, sometimes natural, sometimes blackish, and sometimes light or clay-coloured, indicating a deficiency or total absence of bile. When not pointed out by the diminished number or apparent condition of the stools, the affection may be suspected to exist, if the patient complain of a sense of weight or oppression in the abdomen or at the fundament, a frequent but ineffectual disposition to go to stool, flatulence, colicky pains, distension of the abdomen, and nausea with or without vomiting. Attention to these points is the more important, as in some cases of great fecal accumulation, whether in the rectum or higher up in the colon, the irritation of the bowel gives rise to occasional mucous discharges, tinged with fecal matter, and having a very offensive fecal odour; or small quantities of the liquid contents of the bowels are forced around the mass, or through an opening existing in it, and discharged per anum, so as to simulate diarrhœa. Sometimes the discharges are bloody or dysenteric in character. Such a condition is peculiarly apt to occur in old people, and has not unfrequently been treated as diarrhœa, to the great detriment of the patient. There is in some instances difficulty in passing urine. If a case be attended by more or less of the above symptoms, constipation should be suspected, and a close examination instituted. If the feculent mass be lodged in the rectum, it will at once be detected by introducing the finger through the anus; if in the colon, it will often be obvious in the form of a hard tumour or tumours in the left iliac fossa, or in the course of the descending, transverse, or ascending colon; and, when the solid mass cannot be felt through the abdominal parietes, it may often be detected by the flat sound which it will yield on percussion. There is reason to believe that such masses have not unfrequently been mistaken for organized tumours. The impossibility of introducing an injecting pipe far into the rectum, or the great resistance made to the entrance of liquids through the instrument, often leads to the detection of these accumulations. The quantity of feculent matter which has sometimes accumulated in constipation is enormous. A case is recorded in the *Archives Générales* (iv. 410), in which thirteen and a half pounds were found in the intestines. The length of time also, during which patients sometimes sustain a complete want of alvine dejections, is astonishing. From one to two weeks is no uncommon period, in the experience of most practitioners; and cases are on record in which the patient has survived months of suffering from this cause. But, in most of these cases, the dejection per anum has been replaced by a vomiting of feces, so as to prevent a fatal distension. Generally speaking, should the constipation not yield to appropriate treatment, symptoms of an alarming character come on in the course of a few days, and the case ends fatally, after a longer or shorter period of much and various suffering, with occasional remissions and exacerbations, as temporary relief is obtained from vomiting, the use of remedial measures, or other causes. (See *Obstruction of the Bowels.*)

Causes.—Constipation is either occasional, arising from some temporary cause, or protracted and habitual. In both cases, its pathological condition must consist in either 1. a mechanical impediment to the passage of the alvine contents along the bowels, 2. a diminished contractility of the muscular coat, or a diminished susceptibility of the intestines to the influence of the usual alvine stimuli, 3. a deficient supply of these stimuli, or 4. a combination of two or more of the conditions mentioned. The causes must be such as are capable of inducing these conditions.

Among those which occasion mechanical impediment are solid masses formed out of the ingesta, or by precipitation from the intestinal liquids; spasmodic or permanent stricture of the bowels; the encroachment of organized tumours upon their caliber; and strangulation of the intestines, as in hernia, intussusceptio, and twisting of some portion of the tube. These will be more particularly considered under *obstruction of the bowels.*

The causes which impair the contractility or susceptibility of the bowels, or both, are of more importance in relation to our present subject. These operate more especially upon the colon, though their influence is also felt throughout the intestinal tube. Torpor of the colon is one of the most common conditions in habitual constipation. Unable to contract sufficiently on the feculent matter, or unduly insensible to its presence, the bowel becomes distended by the accumulation which takes place, and, under the distension, suffers a still further diminution of its power and sensibility. The causes of this condition are numerous. They are, for the most part, the same as those which produce the analogous condition of the stomach existing in dyspepsia; as sedentary habits, excessive mental occupation, sensual indulgences of all kinds, morbid diversion of the blood and nervous energy to other organs, the use of narcotics and especially of opium, diseased conditions of the brain and spinal marrow, and, in fine, whatever debilitates the system generally, and consequently involves the bowels. (See *Dyspepsia.*) Old age is attended with a diminished susceptibility of the alimentary canal, and is therefore very subject to constipation. Habit also has a powerful influence, and is indeed one of the most frequent causes of the complaint. By means of our control over the sphincter ani, we are endowed, to a considerable extent, with a power of regulating the alvine discharges, and of resisting the solicitations of nature at inconvenient seasons. This power is too apt to be frequently exercised, and especially by females. The bowel is thus habituated to the presence of the feculent matter, feels less and less its wholesome stimulation, and at length ceases to be excited into action. Habitual constipation is a necessary result. The preparations of lead have a directly paralyzing effect upon the bowels; and obstinate costiveness is therefore an almost uniform attendant on colica pictonum.

Of the causes which impair the stimulant properties of the intestinal liquids, the most common is perhaps a diminished or suspended secretion of bile, or anything which impedes its access to the bowels; the bile being one of the most energetic alvine stimulants provided by nature. Hence the frequent deficiency of the bilious colour in the evacuations. The same may possibly be true to a certain extent of the pancreatic liquor, and is certainly so of the intestinal mucous and serous secretions. Hence the influence of excessive discharges from other organs, as from the skin and kidneys, in producing costiveness. Hence, too, the action of astringents, which diminish or arrest the intestinal secretion. Dr. Dick ascribes the costiveness of the young, in some instances, to a too rapid absorption of the intestinal liquids. (*Braithwaite's Retrospect*, xvii. 152.)

Many of the causes above enumerated operate doubly, impairing the contractility and sensibility of the bowel, while they diminish the amount of healthy stimulus by checking secretion. Such especially are those which act through the medium of the brain and spinal marrow. Excessive exercise often produces this effect by directing the energies of the system to other parts. A disposition to constipation is a very common attendant upon a long and fatiguing journey.

Effects.—Constipation gives rise, especially when habitual, to a great diversity of local and constitutional derangements. Besides its effects upon the bowels, consisting in irritation, inflammation, distension, ulceration, gangrene, &c., it deranges the neighbouring organs by the pressure of the accumulated feces; impedes from the same cause the abdominal circulation, and thus occasions various congestions; extends a sympathetic irritation to the viscera of the abdomen and pelvis, as well as to the brain, heart, and other distant parts; and finally gives rise to contamination of the blood, both by checking the secretion of excrementitious matter, and by causing a reabsorption of that already eliminated from the blood-vessels, and of various products of chemical change in the retained contents of the bowels.

It is often attended, even in its occasional attacks, with dulness, depression of spirits, drowsiness, irritability of temper, vertigo, headache, flushing of the face, pains in the loins and limbs, palpitation, dyspnœa, furred tongue, gastric derangement, and various disorder in the biliary, urinary, and generative organs. When habitual, it produces the same effects in an aggravated degree, and others even more unpleasant. Bleeding from the rectum, hemorrhoidal tumours, fissures and prolapsus of the anus, fistula in ano, strangury, catarrh of the bladder, dysmenorrhœa, amenorrhœa, menorrhagia, leucorrhœa, colic, diarrhœa, dysentery, hepatic congestion and inflammation, dyspepsia, sick-headache, foul breath, epistaxis, apoplexy, epilepsy, paralysis, hysteria, melancholy, hypochondriasis, and insanity, are among the disorders which have been traced to constipation as their source.

It is not always easy to say, how much of the disease which is found associated with constipation is properly its effect. Derangements of the same kind as those which it induces arise often also from other causes, and may bring on this condition of the bowels if not previously existing. But, even in this case, it often aggravates the original disorder; and thus, whether viewed as cause or effect, is still a source of mischief. Not unfrequently, the complaints which originate in constipation take on an independent existence, and continue though the cause may cease. From all these considerations, it follows that the disorder in question, whether original or induced, requires a close attention, and should be immediately made an object of treatment whenever it occurs.

Treatment.—Occasional attacks of constipation must be met by cathartics, proportionate in their activity to the difficulties of the case; the milder being first employed, under ordinary circumstances, and the more energetic resorted to after these have failed. Castor oil is, from its combination of mildness with quickness and efficiency, one of those best adapted to ordinary cases. Sulphate of magnesia and the other saline cathartics may also be used, and are especially applicable to solid fecal accumulations, in consequence of the copious serous secretion they induce, which penetrates and breaks down the impacted mass. Senna tea combined with the salt adds to its efficiency, by the energetic influence which this cathartic exercises upon the muscular coat. Croton oil should be employed, when those mentioned have proved insufficient. It is preferable to most other drastic cathartics by its quicker action and greater energy, while less disposed to produce inflammation of the bowel. Cases, however, may occur in which, from great insensibility of the intestines, the irritant properties of jalap resin, scammony, colocynth, gamboge, or even elaterium, given separately or in combination, may render them preferable. *Calomel* should always be employed, in full doses, when the constipation is dependent on torpidity or congestion of the liver. It not unfrequently happens that, after the gums have been touched by the use of mercurials, other cathartics will act with facility which had failed before. Dr. Daniel, of Savannah, recommended *charcoal* very highly as superior to all other remedies in obstinate constipation. He gave from one to three tablespoonfuls every half hour or hour, and found it successful in numerous instances. (*Philad. Journ. of the Med. and Phys. Sci.*, v. 119.) The remedy, however, has not succeeded so well in other hands, and is liable to accumulate in the bowels, so as itself to become a source of obstruction.

Should the purgative not operate in due time, it should be aided by enemata, which sometimes become indispensable, in consequence of an irritability of stomach which precludes the use of most cathartics by the mouth. The reader is referred to the article on colic (*page* 624) for an account of the substances which may be used in this form. Perhaps, upon the whole, the most safe and at the same time efficient, in cases of great obstinacy, is simple warm water thrown up the bowel, in very large quantities, by means of a self-injecting apparatus, and repeated so as gradually to soften and wash away the feculent matter. Any desirable quantity of water may thus be introduced into the bowels, if care be taken, by twisting a towel round the pipe and pressing it against the fundament, to aid the contractile power of the sphincter. Advantage may occasionally result from introducing the water directly into the colon, through a long gum-elastic tube, passed high up into that bowel. When the feces are impacted in the rectum, the assistance of the finger, a scoop, spoon-handle, or some similar instrument, introduced per anum, becomes necessary to break up and discharge the solid mass. Other measures may be employed in aid of those mentioned, as friction over the abdomen, warm vapour to the fundament, and the application of cold externally, either by ice to the palms of the hands and soles of the feet, or by a stream of cold water allowed to fall upon the abdomen. Spasmodic stricture of the bowels has sometimes given way under this latter measure, after resisting purgatives and enemata. The application of cloths wet with ice-water to the abdomen, and the free use of ice-water internally, persevered in for days if necessary, is an old remedy, which is said to have proved very effectual in ileus. (See *Boston Med. and Surg. Journ.*, xxxvii. p. 229.) The late Dr. Hosack, of New York, was in the habit of employing emetics of tartarized antimony and ipecacuanha in obstinate constipation, and ascribed their beneficial influence partly to the increased action of the liver, and partly to the relaxation of spasm which they occasioned. (*Philad. Journ. of Med. and Phys. Sci.*, iv. 337.) The use of *metallic mercury*, in large quantities, is asserted to have sometimes overcome constipation under almost desperate circumstances. (See *Obstruction of the Bowels.*)

It is highly important that the practitioner should bear in mind the occasional dependence of obstinate constipation upon local inflammation of the intestine, affecting either the muscular or peritoneal coat, and entirely restraining the peristaltic motions of the part. In such cases, persistence in the use of violent cathartics can do only harm. Bleeding, general and local, calomel and opium internally, occasional enemata, with emollient applications and blisters, are the chief remedies; and they will often succeed most happily after failure with active purgatives.

In *habitual constipation*, a somewhat different course must be pursued. Attention must here be especially paid to the removal of the cause. Efforts should be made by the patient to establish the habit of regular evacuations by daily attendance at the privy, though it is important that he should avoid severe straining, which often gives rise to hemorrhoids, or prolapsus ani. Moderate exercise, regular habits of life, relaxation from intense mental occupation, change of air and scene, all have a favourable effect by contributing to the restoration of tone to the bowels. Frictions over the whole surface of the body, and the occasional use of the cold or shower-bath contribute to the same end; and, whenever the excess of any function may be found to divert the due supply of vital energy from the colon, this excess should if possible be corrected. The use of all narcotic substances, including green tea and coffee, should be abandoned, when there is reason to believe that the complaint depends on torpor of the intestines.

The regulation of the diet is highly important, and this alone will frequently be sufficient to restore the proper action of the bowels. The food should in general be easily digestible, and such as is not calculated to yield a large amount of feculent residue. (See *Dyspepsia.*) An exception to this rule may sometimes be made in favour of substances having laxative properties; but discrimination is necessary. Laxative articles of diet are apt to be of difficult solubility in the stomach, and are not all adapted to a dyspeptic state of that organ. Such as are of this character should therefore be avoided, or used cautiously, in constipation associated with dyspepsia. Bran bread, however, or some other preparation of wheat flour containing bran, may often be employed with great advantage in this case. Dr. John C. Warren, of Boston, recommends highly a preparation made by grinding wheat coarsely in a coffee-mill, adding a little salt, and then boiling for three or four hours, adding water from time to time, so as to bring it to the consistence of hominy. (*Am. Journ. of Med. Sci.*, N. S., xvii. 296.) When the stomach is not dyspeptic, fresh and dried fruits are highly useful. Indeed, it is not uncommon for persons, disposed to costiveness, to be entirely free from this condition at those times of the year when fruits are in season. The different edible berries, peaches, pears, apples, melons, &c., may be taken as freely as the stomach will admit without inconvenience; and tomatoes, used as a vegetable at dinner, have been found highly beneficial, even by dyspeptic persons. In the winter, the imported fresh fruits, such as grapes and oranges, and the dried fruits, such as dried peaches, prunes, figs, &c., may be substituted. Other laxative articles of diet, applicable to cases in which the digestion is vigorous, are brown sugar, molasses from the plantations, honey, olive oil, rye and Indian meal in the form of mush or bread, oat-meal gruel, rennet-whey, and buttermilk. Broths are sometimes preferable, under similar circumstances, to solid food. Burne recommends the use of bacon at breakfast. An exclusive diet of milk has sometimes appeared to produce very obstinate constipation; and this fact should be attended to in the treatment of children.

When constipation is found to be connected with deficient secretion of bile, an alterative mercurial course, or the use of nitro-muriatic acid should be resorted to. A calomel purge may be given at first, and afterwards half a grain or a grain of the same mercurial, or three grains of the blue mass every night or every other night, followed by a drachm or two of sulphate of magnesia, or other mild laxative in the morning.

Laxative medicines are often indispensable. In the choice of these, reference must be had to the peculiar condition of the stomach and bowels. When the former is weak, and the latter irritable, as in dyspepsia, atonic gout, &c., the warm tonic laxatives should be selected, and may often be advantageously combined with bitter extracts, chalybeates, or other tonics. Aloes and rhubarb, separate or combined, are most employed, and are often mixed with extract of gentian or quassia, and pill of carbonate of iron. But aloes should not be used in cases attended with hemorrhoids or irritated uterus. White mustard seed, in the dose of a tablespoonful daily or twice a day, are often advantageous under similar circumstances. Infusion of senna, with columbo and ginger or other aromatic, is also well adapted to constipation complicated with feeble digestion. The torpid bowels of old people require the more stimulating cathartics. Besides aloes and rhubarb, the drastic purgatives may be used in small doses and combined together, as in the compound extract of colocynth, or the compound cathartic pill of the U. S. Pharmacopœia; and with the cathartics, Cayenne or black pepper, assafetida, myrrh, ammoniac, &c., may be advantageously associated. Not only in these cases, but in all others where the bowels are very torpid, even in the cases of infants, I have been in the habit of combining minute quantities of croton oil with other laxatives, especially with aloes and rhubarb, with the happiest effect. The quarter or sixth of a drop, for adults, will be found to add considerably to the activity of the dose, and generally without irritating the stomach.

When the stomach is not very feeble, the saline laxatives may often be used with propriety. They have this advantage, that they are less apt than some others to leave the bowels in a costive state; and are peculiarly applicable to cases attended with deficient intestinal secretion. A very small quantity of one of these salts, a drachm or two of Epsom or Rochelle salt, for example, taken on an empty stomach, early in the morning, will often act sufficiently. The Seidlitz powder suits some stomachs admirably well. The natural combinations of salts existing in mineral waters are often more effectual than the salts separately. The different waters of the Saratoga springs are deservedly in high repute. The Cheltenham salt made in imitation of the Cheltenham water in England, and containing a chalybeate associated with the saline ingredients, has answered admirably in my experience. But the alkaline salts have the disadvantage in general, that, when long continued, they debilitate the stomach and impair digestion.

When the digestion is good, the confection of senna or lenitive electuary is an excellent laxative. Given at bedtime, in the dose of a drachm, it usually causes a soft feculent evacuation in the morning, without irritation, or other inconvenience. It is peculiarly suited to constipation with piles. Powdered senna, mixed in very small proportion with stewed dried peaches or prunes, operates in a similar manner. A drink made from *cream of tartar*, in imitation of lemonade, may be used in similar cases, and is often grateful in summer. *Flake manna*, carried in the pocket, and eaten occasionally, is also adapted to costiveness with unimpaired digestion.

Some persons are able to take castor oil without disgust, and find it useful in habitual costiveness; but in general the stomach cannot be reconciled to its very frequent use. With others, olive oil answers the same purpose, though it requires to be given in larger doses.

Sulphur is adapted to cases as well of feeble as of vigorous digestion, and, as it produces unirritating passages, may be usefully employed in piles. In consequence of its alterative properties, it as an excellent laxative in the costiveness of rheumatic and gouty individuals. It is often associated with magnesia in dyspeptic cases, and with cream of tartar in inflammatory piles. Its disadvantages are that it is apt to occasion griping, and in time imparts odour to the breath and secretions.

Magnesia and its carbonate are peculiarly useful in cases attended with excess of acid in the stomach. It should not, however, be used largely and habitually, unless in association with other laxatives to insure its action; as it has sometimes accumulated in the bowels, and formed masses interfering with their due movement.

Some have employed enemata or suppositories as substitutes for cathartics by the mouth, administering them daily, or every other day, for a long time together. The mildest substances should be selected; as flaxseed tea or other mucilaginous liquid for injection, and hard soap or solidified molasses for introduction in the solid form. But both are liable to the objection, that they concentrate in one part of the bowels the irritation which the laxative medicine spreads, in a comparatively diluted state, over their whole track; while they do not so effectually evacuate the upper portions of the canal.

But laxatives either by the mouth or rectum should be employed only as adjuvants to a properly regulated regimen, and should be suspended the moment that they are no longer necessary. Care should also be taken to administer them in doses no larger than is essential to the end desired.

They should always be given on an empty stomach, as they thus operate more speedily and with less uneasiness. Half an hour or an hour before breakfast, an hour or two before dinner, and at bedtime, without previous supper, are the proper periods. Given at bedtime, they will often not act until morning, and the patient will experience little or no inconvenience during the night; while he thus escapes the annoyance of their operation during the day. This, therefore, upon the whole, is the most appropriate time.

In cases dependent on deficiency of contractile power in the muscular coat, nux vomica or its active principle, strychnia, has been employed with great success; and, as it is not always possible to distinguish these cases, the remedy may be tried in any case of habitual constipation, where this cause may be supposed on probable grounds to exist.

Various other measures have been employed in habitual costiveness. The *introduction of a bougie* high up into the rectum is favourably spoken of by Burne, who recommends it especially in cases attended with great rigidity of the sphincter ani. The *smoking of tobacco* has in some persons been found to obviate constipation, though in others it occasions it, when used in excess, by impairing the sensibility of the digestive tube. *Friction* to the abdomen with rubefacients, coarse flannel, or the flesh-brush; *tepid or cold affusion* upon the loins; and *leeches* or *cups to the spine*, when the constipation may be supposed to have its origin in disorder of the medulla spinalis, have been recommended. *Electro-galvanism* has also been found useful, a current being directed through the bowels, by applying the end of a wire from one pole to the sacrum, and from the other to various points along the course of the colon upon the front of the abdomen.

Article V.

OBSTRUCTION OF THE BOWELS.

This term, as here employed, implies the existence of some mechanical impediment to the passage of the contents of the bowels. The obstruction sometimes comes on slowly, with the ordinary symptoms of constipation, the patient experiencing gradually increasing difficulty in obtaining evacuations until they cease. In many instances, however, the attack is sudden, and altogether unexpected. It often happens that, for a few days after the cessation of discharges, no great inconvenience is felt; but sooner or later, and sometimes immediately, the patient begins to complain of uneasiness in the abdomen, attended frequently with a desire to go to stool, and bearing down efforts, which are either quite ineffectual, or produce only slight, bloody, mucous, or feculent passages, without affording relief. Cathartics are taken without effect, and enemata, after evacuating occasionally small quantities of fecal matter, come away as administered. The discharges which thus occur spontaneously, or are obtained artificially, consist only of matters contained in the bowels below the point of obstruction; and care should be taken that they do not lea[illegible] the nature of the affection. Distension of the abdomen now comes on, with flatulent eructation, severe spasmodic pain, great restlessness and anxiety, and at length nausea and vomiting, so that substances taken into the stomach are instantly rejected, and medicines cannot be retained. Symptoms of inflammation, as tenderness upon pressure, a quick pulse, and furred tongue, are often mingled with those of obstruction. Should relief not be obtained, troublesome hiccough occurs; the vomiting not unfrequently assumes a stercoraceous or bloody character; dysury, with deep-red urine, is added to the other symptoms; the belly becomes enormously distended and tympanitic, the respiration oppressed, the face bathed in sweat, the skin pale and clammy, the extremities cold, the pulse exceedingly feeble, and the countenance haggard; and the patient sinks, completely worn out and exhausted, death being frequently preceded by delirium. This, however, is not the uniform result. The vomiting of feces sometimes affords temporary relief; the worst symptoms disappear, to occur again when the bowels become again loaded; or the obstruction may be partially removed by an effort of nature, and again return; and a course of suffering and exhaustion, alternating with partial relief and reaction, may continue for months, or even years, ending at last in death, or in a complete removal of the obstruction, and recovery. It is singular how, in some cases, the system accommodates itself to defecation by the stomach, so as to dispense for a long time with the ordinary alvine evacuations. Dr. Crampton relates, in the *Dublin Hospital Reports* (vol. iv.), the case of a young woman, living at the time, who for seven years had laboured under stercoraceous vomiting, with obstinate constipation, having had stools at distant intervals, only two or three during the year preceding the report, and none at all during the last eight months. Another case of a young female was reported by Dr. Franklin Bache, in the *N. American Med. and Surg. Journal* (vol. vi. p. 262), which continued for a period of ten months, during which there was several times an absence of stools for more than twenty days, and once for eighty-seven days, and yet the patient ultimately recovered. In both these cases, the stercoraceous matter vomited had occasionally a strong urinous smell, and there was, during longer or shorter periods, suppression or retention of urine. These latter phenomena are not uncommon attendants upon obstinate constipation.

The names of *Ileus* and *Volvulus* have been given to cases of stercoraceous vomiting, with pain in the bowels, and constipation. There is nothing, however, in this association of symptoms, which entitles it to be considered as a distinct disease. This kind of vomiting may occur in violent colic, from a spasmodic closure of the bowel; and it is asserted to have sometimes arisen from a mere morbid inversion of the peristaltic movement, without any obstruction; water introduced into the rectum having been thrown out from the mouth. The ileo-cæcal valve offers an impediment to the upward passage of the contents of the colon; but, if it be admitted that the pressure of the fluids above and below the valve is about equal, the valve may be flaccid, and an intermixture of the fluid matters on each side of it in some degree take place. (Roper, *Lond. Med. Gaz.*, Oct. 1849, p. 623.)

In cases presenting the above symptoms, a close examination of the abdomen should be made, in order to ascertain whether the cause of the phenomena may not be *strangulated hernia*. There is reason to think that death has frequently occurred from a neglect of this precaution.

Dissection after death exhibits the intestine very much distended, in some instances enormously so, above the place of obstruction. Marks of inflammation are frequently observed, and sometimes those of gangrene. According to Burne, when the obstruction depends upon a purely mechanical cause, and not upon feculent accumulation arising from functional derangement of the bowel, the feces are always found soft; a provision of nature which tends to prolong life, by enabling the bowels to relieve themselves until the passage becomes absolutely closed.

Causes.—One of the most frequent causes of obstruction is *an accumulation of impacted feces.* This, though the result of a pre-existing functional derangement of the bowels, becomes itself, when so considerable as to close the passage, and to resist the peristaltic movement, the chief source of mischief; and the obstruction, therefore, may be strictly said to be mechanical. This is the form of the complaint which is least dangerous, and most easily relieved by proper measures. A case is mentioned by O'Beirne, in which the patient had been without an evacuation from the bowels for nearly six months, in consequence of a mass of solid excrement in the sigmoid flexure, and yet was relieved by a stimulant injection thrown high up into the rectum. (*New Views of the Process of Defecation.*) Such accumulation may be suspected to exist, when the symptoms of obstruction have been long preceded by those of habitual constipation, without any evidence, from the appearance of the stools, of the existence of stricture. The means of detecting it have been already detailed. (See *page* 636.)

Another not uncommon cause of obstruction is the *formation of solid concretions* in the bowels. These have their seat most commonly, for obvious reasons, in the rectum, sigmoid flexure, or cæcum; though they may exist in other parts of the colon, and even in the small intestines. They originate in various sources. Insoluble substances taken largely and frequently as medicines sometimes concrete in the bowels, held together by a cement of animal matter or calcareous salt, and frequently mixed with indigestible portions of substances used as food. Cases are on record of serious obstruction proceeding from the daily and continued use of chalk, sulphur, magnesia, and subcarbonate of iron. The stones of various fruits, especially of cherries and plums, swallowed along with the pulpy matter, under the impression that they assist digestion, frequently form concretions in the bowels, which have, in some instances, given rise to fatal obstruction. Sometimes solid masses are formed out of the secretions poured into the intestines, especially from the bile; and these concretions are occasionally found to have as a nucleus some insoluble substance accidentally swallowed. They are not generally numerous, seldom exceeding two or three; but in some instances many have been found, and of various sizes, from a few lines to two inches or more in diameter. When there are several, they can sometimes be felt rubbing against each other. When obstruction has arisen from any of the concretions above referred to, a probable inference as to the cause may be drawn from the previous habits of the patient, which should always be inquired into. Their nature may occasionally be detected by examination per anum; and, when beyond the reach of the finger, they may often be felt through the parietes of the abdomen, especially in the right and left iliac fossæ; and will always occasion undue flatness on percussion. When tenesmus attends obstruction, an examination of the rectum should never be omitted.

Permanent stricture of the bowels is a third source of obstruction. This appears sometimes to originate in a spasmodic stricture becoming permanent by inflammatory adhesion; but, in most instances, it depends on a thickening of the parietes of the bowel, and a consequent diminution of its caliber. Cancer is probably one of the most frequent causes of this thickening. It may depend also upon a simple inflammatory hypertrophy of the submucous cellular tissue, or on the cicatrices following large ulcers; and Dr. Symonds has pointed out another cause in a fatty deposition beneath the peritoneal coat. The stricture is most frequent in the rectum, but it is also found in various parts of the upper bowels. When in the former situation, it may be detected by the finger or a bougie; and its existence may be suspected when the obstruction has come on by degrees, and the feces have been discharged for a long time previously in gradually diminishing cords or ribbons. In many instances, however, it cannot be ascertained until after death.

Tumours, cancerous or non-cancerous, projecting into the cavity of the bowel, are another cause.

Organized bands across the bowel sometimes produce obstruction. These probably originate in an inflammatory adhesion of the surfaces of the mucous membrane, in consequence of the effusion of coagulable lymph, and a subsequent separation of these surfaces, before the lymph has become quite consolidated, so that it is drawn out in apparently interlacing cords. These bands are said to be most common in the rectum, though a fatal case is given by Burne, in which the seat of the obstruction was in the cæcum. (Burne *on Habitual Constipation.*) They are very rare.

Adhesions of the peritoneal coat of the intestines, arising from inflammation, sometimes produce bands, which, in certain positions of the bowels, act as a cause of external stricture, and produce fatal obstruction. Under this head may perhaps be included the strangulating operation of the *appendicula vermiformis encircling the bowel*, and bound in its abnormal position by inflammatory adhesion; and also of those accidental processes denominated diverticula, which have been known to bridle the intestine in a similar manner.

Intussusceptio, or *invagination* of the bowel, is a frequent and fatal cause of obstruction. This consists of the introduction of one portion of the intestine, by inversion, into the portion immediately above or immediately below it, thus producing, in many instances, a complete closure of the cavity. The upper portion is generally received into the lower, but not invariably so; the inversion sometimes taking place from below upward. The extent of the invagination varies from a few lines to a foot or more. Sometimes it is enormous. I attended, with Dr. Ashmead of this city, an infant with fatal intussusceptio, in which, during life, a hard tumour could be felt extending from the pubes along the left side to the middle of the arch of the colon; and, after death, it was found that the right half of the arch, the whole of the ascending colon, the cæcum, and a large portion of the ileum, had entered the lower half of the large intestine, and that most of the duodenum with a portion of the jejunum had been drawn, for a short distance, into the same opening. Intussusceptio occurs not unfrequently in more than one part of the bowels in the same case, and probably arises from a spasmodic constriction of the entering portion of the intestine. There is reason to believe that it frequently takes place during colic, and other spasmodic intestinal affections, without producing serious effects, being relieved by the spontaneous movement of the bowels. Almost any portion of the bowels may become the seat of the affection; but it is said to occur most frequently either at the union of the small with the large intestines, the former being in this case received into the latter, or at the arch of the colon. It is not uncommon in the small intestines, and I have seen it involving the sigmoid flexure and upper part of the rectum. Inflammation not unfrequently takes place, and, by causing tumefaction and adhesions, greatly aggravates the danger. Even in this case, however, the affection, though generally fatal, is not necessarily so. The invaginated portion of bowel mortifies and sloughs, while adhesion is established between the peritoneal surfaces of the upper and lower portion at their place of junction; and, if the constitution of the patient is sufficiently vigorous or pliant to support the shock of the obstruction, inflammation, and gangrene, and the long subsequent exhausting processes of sloughing and reparation, an effectual recovery eventually takes place. The diagnosis of intussusceptio is at first always uncertain. It may be suspected when the symptoms of obstruction come on suddenly, without previous disorder, or as the consequence of an attack of colic, or the administration of a dose of active purgative medicine, and when at the same time a tumour, not previously existing, can be felt in any part of the colon. In those cases which continue long, portions of the bowel that have sloughed away are sometimes found in the stools, after the restoration of the alvine evacuations, proving the nature of the obstructing cause.

Twisting of the bowel is still another cause of obstruction. A fold or loop of the intestines sometimes turns round upon itself, and, as in the case of Mr. Legare, reported by Dr. Bigelow (*Boston Med. and Surg. Journ.*, July 5th, 1843), may even make two complete revolutions, thus entirely preventing the passage of the feces. This rotation appears sometimes to occur in consequence of external violence, as in a case of Sir A. Cooper's, described in Burne's work on habitual constipation; but more frequently without any known cause. It is most apt to take place in the convolutions of the small intestines, or at the sigmoid flexure of the colon. In its severer forms it is irremediable; but it is probable that slight turns of the kind are susceptible of being untwisted by movements of the bowels, either spontaneous or excited by medicines. There are no means of ascertaining its existence during life; but it may be conjectured to have occurred, when the obstruction is sudden, and unattended with any discoverable tumour.

Still another cause of obstruction is strangulation by the passage of the bowel through some abnormal opening, as, for example, through a rent in the mesentery or mesocolon.

Organic tumours, formed exterior to the bowel, may sometimes so diminish its caliber as to produce obstruction; but this result is rare; the impediment being seldom so great as altogether to prevent the passage of feces.

Treatment.—The first object in any particular case of obstruction is, if possible, to ascertain the cause; so that the treatment may be modified accordingly. But, when this is obscure, or altogether uncertain, as often happens, that plan should be adopted which is most likely to be useful in curable forms of the complaint. As a general rule, the following course of treatment is recommended.

If the pulse and constitution admit, and especially if symptoms of inflammation exist, blood should be taken freely from the arm, and leeches applied to the abdomen or the anus. Spasm of the bowel, which, if not the cause of the difficulty, may greatly aggravate it, may thus be relaxed, while the dangers from inflammation are obviated. Purgatives should be immediately resorted to, as recommended for occasional constipation (see *page* 640); and these should be aided by suitable enemata. For the composition of the enemata, the reader is referred to the article upon simple spasmodic colic. (See *page* 624.) But, in relation to the use of purgatives, some caution is requisite. When the vomiting is very obstinate, and especially when it has become stercoraceous, there is strong evidence that the peristaltic movement of the bowels is exerted to its utmost limits; and the only effect of powerful and drastic cathartics would probably be to increase the existing irritation or inflammation, and still further to aggravate the vomiting. The reparatory processes which nature might be disposed to institute may thus possibly be interfered with, and a curable case rendered incurable. At the beginning of the treatment, active purges may be employed; but, when found unsuccessful, they should not be urged under the circumstances mentioned. Effervescing aperient medicines, or the saline cathartics, given in small doses in carbonic acid water, should be preferred, as more acceptable to the stomach, and calculated to direct downward the already excited peristaltic action. Calomel may also be given in moderate and repeated doses; as it is often well retained by the stomach, and, if it do not purge, may produce a general mercurial impression, which has often proved highly salutary under very unpromising circumstances. According to Burne, the addition of a drop of creasote to the purgative dose, when the stomach is very irritable, will often enable it to be retained, when it would otherwise be rejected.

During the above treatment, opiates should be freely used to allay pain and relax spasm; and warm fomentations and the warm bath will be found useful auxiliaries. Indeed, where there is reason to think that further attempts at purgation can be of no avail, but may even prove injurious, opium is the remedy which is to be mainly relied on, so far as the stomach is concerned. The repeated injection of large quantities of warm water into the bowels, by means of a forcing pump, as recommended in obstinate cases of constipation (see *page* 639), is one of the most efficient remedies. If the obstruction consists in fecal masses or other concretions, it may thus be loosened, broken down, and gradually brought away; if in intussusceptio or twisting of the bowel, there may be some hope, in the one case, of pushing up the invaginated intestine by the force of the stream, provided adhesions have not been formed, and in the other of untwisting the rotation by an impulse opposite to that which produced it. To insure its full effect, however, the fluid should be introduced by means of a tube passed as high as possible into the bowel. Even the ordinary purgative and stimulant injections prove much more efficient when introduced in this way. Dr. O'Beirne succeeded in causing, by a single stimulating injection thrown through a tube passed nine or ten inches up the rectum, the breaking up and discharge of a great fecal mass, which had been lodged for six months in the sigmoid flexure, and during that period had resisted purgatives, and numerous enemata exhibited in the ordinary manner.

There is often great difficulty in passing a tube through the sigmoid flexure; some obstacle to its passage being offered about eight or ten inches above the anus, so that the tube often curves upon itself, and forms a coil in the rectum. This difficulty is ascribed by O'Beirne to a contraction which he supposes always to exist in the upper part of the rectum, in the ordinary state of the bowel, and to relax only when the accumulation of feculent matter in the colon is such as to require evacuation; the rectum being, in his opinion, merely an instrument for the expulsion of the feces, and not a reservoir for its reception. To overcome this constriction, he recommends that the instrument be pressed steadily against it with considerable force, though not sufficient to endanger the penetration of the coats of the rectum; an accident which has happened from the incautious use of bougies. (*New Views of Defecation, &c.*) Others consider the difficulty as resulting from the projection of the sacrum, or the oblique direction of the bowel, and recommend the employment of a bent director, or the injection of some water through the tube when it reaches the curved part, so as to distend the intestine, and keep the tube in the middle of the stream.

Tobacco enemata have sometimes been found effectual in very threatening cases, but must be used very cautiously. (See *page* 625.) Dr. Alexander succeeded, in an obstinate case, by introducing a long tube into the rectum, throwing up through this, by means of a syringe fitted to it, more than a pint of warm water, and then withdrawing the piston of the syringe, so as to *bring atmospheric pressure to bear upon the bowel.* (*Lond. Med. and Phys. Journ.*, Dec. 1827.) *Metallic mercury* has by its great weight forced obstructions which have resisted other means. It is recommended in the quantity of a pound or more, given in doses of four ounces at intervals of a few hours; but it should be employed only as a dernier resort. *Cold water thrown upon the lower extremities and abdomen* has occasionally proved effectual in obstinate cases. Dr. R. H. Townsend, of Philadelphia, succeeded in overcoming an obstruction which threatened speedy death, by first throwing a quart of ice-cold water into the rectum, then suspending the patient by his feet to the ceiling of the chamber, and kneading the abdomen with considerable force. The signs of obstruction immediately ceased, and in fifteen minutes the patient evacuated the injected water with feculent matter. (*Am. Journ. of Med. Sci.*, N. S., xviii. 547.)

Efforts for the relief of the patient should never be abandoned so long as life continues. If one measure fail, another should be tried, and nothing which affords any reasonable prospect of advantage should be neglected; for success has often rewarded the efforts of the practitioner, in these cases, when there scarcely seemed to be ground for hope. When the strength of the patient begins to fail, it should be supported by stimulants and nutritious food. Wine-whey, carbonate of ammonia, egg beat up with wine, milk-punch, animal broths, &c., may be employed. Lime-water and milk, in small and frequently repeated doses, will sometimes lie upon the stomach, when other nutriment is rejected. Opiates should be administered throughout the case, if required to give ease or produce sleep. In low states of the system, it may be proper to employ the purgative tinctures, as those of rhubarb, aloes, senna and jalap, &c., preferably to other forms of cathartic medicine. In those cases which run on for months, it will be necessary to watch their progress carefully, in order to meet any offered indication, and favour the recuperative efforts of nature.

A few remarks may be made in reference to particular cases of obstruction. Should the complaint depend upon feces or concretions lodged in the rectum, the aid of the finger or of instruments should be resorted to. (See *page* 639.) The latter, if cautiously used, may be even applied to similar obstructions at the lower extremity of the sigmoid flexure. If there be reason to suppose that magnesia has concreted in the bowels, acidulous liquids should be given with the purgative. When the obstruction depends on stricture of the rectum, resort should be had to the bougie, unless in cases of scirrhus or cancer, in which this instrument can do no good, and may prove injurious by tearing the easily lacerated structure. In permanent impediments of this kind, the best plan is to administer frequently small doses of the saline cathartics, so as to keep the passages in a liquid state, and thus prevent irritation. The use of laxative mineral waters has been found very beneficial, under such circumstances, in alleviating the pains and protracting the life of the patient. If there is strong reason to believe in the existence of intussusceptio, twisting of the bowel, or other form of internal strangulation, there may possibly, under peculiar circumstances, and in cases otherwise desperate, be some propriety in opening the abdomen and removing the mechanical impediment; at least the question of an operation may be entertained. A successful case of the kind is referred to in Dr. Eberle's *Practice of Medicine* (2d ed., vol. ii. p. 341), quoted from *Hufeland's Journal* for February, 1826; and another is recorded in the *Edinburgh Monthly Retrospect of the Medical Sciences* (May, 1849, p. 121). Many cases of obstruction from disease of the sigmoid flexure and rectum are on record, in which the descending colon was successfully opened by an incision through the loins or in the groin. Of these cases, some terminated unfavourably immediately after the operation, and others in the course of a few weeks; but, in a considerable proportion, the patients survived a long time, with only the inconvenience of an artificial anus. In most of these favourable cases, however, death ultimately occurred, either from a closure of the artificial opening, or from the progress of the disease in which the obstruction originated. In almost all, the life of the patient was prolonged more or less by the operation.*

Article VI.

WORMS IN THE ALIMENTARY CANAL.

Five different species of worms inhabit the alimentary canal. I shall first briefly describe these parasites, then give some observations upon the symtoms, causes, and management of intestinal worms in general, and lastly treat of what is peculiar, in these respects, to each species.

1. *Ascaris lumbricoides.*—*Round worm.*—This worm has frequently been called *lumbricus*, or in the plural *lumbrici*, from a supposed identity with the common earth-worm, from which, however, it is wholly distinct. It has a cylindrical body, tapering towards the extremities, generally from six to twelve inches long by two or three lines in thickness, smooth, of a whitish, yellowish, or pale-reddish colour, and somewhat transparent when first voided. The head is at the slenderest extremity, and is distinguished by three tubercles surrounding the mouth. The alimentary canal is distinct from the general parietes, and runs from the mouth near one end of the worm, to the anus near the other. The surface exhibits numerous circular fibres, and four longitudinal equidistant lines, the former indicating the course of the muscles, the latter of the nerves and blood-vessels. The two sexes are in different individuals. The male is smaller and much less abundant than the female, and has its tail shortly curved, while that of the female is straighter and thicker. The latter is also distinguished by a constriction, which is the seat of the vulva, at about one-third of the distance from the head to the tail. The external genitals of the male are at the caudal extremity.

2. *Ascaris vermicularis.*—*Oxyuris vermicularis.* Bremser.—*Thread-worm.*—*Seat-worm.*—*Maw-worm.*—This worm is most commonly designated by the plural term *ascarides*. It is the smallest of the intestinal worms, the male not exceeding two lines, and the female being about five lines in length. It is very slender, and of a white colour, and bears considerable resemblance to a small piece of thread, whence one of its names was derived. The head, as in the former species, is furnished with three tubercles, which are but faintly marked, and the body gradually diminishes towards the tail, which, in the female, is slender and pointed; in the male, somewhat thicker, obtuse, and "spirally inflected." The interior structure resembles that of A. lumbricoides.

3. *Tricocephalus dispar.*—*Long thread-worm.*—This worm is an inch or two in length, and consists of two distinct portions, of which the anterior, constituting about two-thirds of the whole length of the animal, is scarcely thicker than a horse-hair, and suddenly swells out into the much thicker but shorter posterior portion. Hence the names *tricocephalus* (from ϑριξ, hair, and κεφαλη, head), and *dispar*, unequal. Like the two preceding worms, this also has a distinct alimentary canal, and the different sexes in different individuals. The digestive tube, commencing in a small orbicular mouth, at the anterior extremity, runs longitudinally through the animal to the anus at the opposite extremity, being straight in the capillary portion, and sacculated in

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* See a statement by C. H. Hawkins, Esq., in the *Lond. Med. Times and Gaz.*, March, 1852, p. 302.

the larger. The male, which is generally found convoluted, is smaller than the female. The former has at the posterior extremity a projecting sheathed spiculum, the latter a foramen which serves both for anus and vulva.

4. *Tænia solium.*—*Common tape-worm.*—*Long tape-worm.*—The tænia varies much in length, being, as generally found, from five to ten feet long, but sometimes reaching sixty, and, according to some writers, upwards of one hundred feet. It is flat, and where largest, three or four lines broad, but tapers gradually towards the anterior extremity, which is slender and thread-like. The body consists of numerous segments, which are most distinct at a distance from the head, and, in the lower part of the worm, are longer than they are broad, resembling when separated the seeds of a gourd, whence the animal has sometimes been called *Tænia cucurbitina*, or *gourdworm*. The head is small and flattish, having a projecting papilla in the centre, furnished with a double circle of hooks, which, however, are sometimes wanting, and surrounded by four equidistant circular somewhat raised disks, depressed in the centre, which have been supposed to be mouths, but in fact appear to be suckers, by which the animal is enabled to attach itself to the surface of the bowel. From these run two parallel canals, one on each side, near the margin of the segments, from one end of the animal to the other, being connected by numerous transverse vessels. These canals are not distinct from the body, but merely passages excavated, as it were, in the parenchymatous tissue of the animal, and therefore differ materially in character from the digestive tube of the three species before described. Each joint has a marginal foramen in the centre of a prominent papilla; and the foramina occur alternately on the opposite sides of the animal. These lateral pores are connected by a duct with an ovarium, occupying the centre of each segment; and the ova, as they escape, are supposed to be fertilized by a fluid derived from a vesicle, the duct of which opens at the same point as that from the ovary; so that in this worm the organs of the two sexes are contained in the same individual.

5. *Bothriocephalus latus.*—*Tænia lata.*—*Broad tape-worm.*—The body of this worm is also long and flat, but is broader than that of the tænia, being from four to ten lines in breadth. It is distinguished also by the shape of the segments, which are broader than they are long; by the form of the head, which is small, elongated, without the hooks and the four circular disks or suckers of tænia, and divided into two lobes by a longitudinal fossa on each side (whence *Bothriocephalus* from βοθριον, a fossa or ditch, and κεφαλη, head); and by having for mouth a single minute pore in the centre between the fossæ, or else two pores, one at the extremity of each lobe. The foramina supposed to be the outlets for the escape of the ova, are situated not on the opposite margins of the segments alternately as in the tænia, but in a single row, each segment having one pore in its centre. The digestive tube is arranged as in the preceding species, being a mere excavation in the parenchymatous substance of the animal, without a distinct coating. The bothriocephalus is said to be somewhat less opaque than the tænia, and, when kept in alcohol, has a somewhat opaline appearance.

The above descriptions are condensed, with some modifications, from those by Dr. Farre, in Tweedie's *System of Practical Medicine*. Other animals besides those described are sometimes found in the human intestines, but none peculiar to this situation. The eggs, larvæ, or young of various insects, worms, lizards, and serpents, have been taken in with the food or drink, or have crept into the mouth or anus during sleep, and, having undergone a greater or less degree of developement in the alimentary canal, have produced derangements of health, sometimes long continued, and of the most serious character. Numerous cases of this kind are recorded in medical journals, or other periodicals; and, much allowance being made for exaggeration, enough remains to justify the above statement. Among the animals particularly enumerated are *Gordius aquaticus*, or horse-hair worm, different species of *Hirudo*, or leech, different species of *Musca*, or fly, *Phalæna pinguinalis*, *Triton palustris*, and *Lacerta aquatica*. (Good, *Study of Medicine*.) But none of these produce symptoms by which they could be respectively characterized. Their effects are essentially the same as those of the proper parasites of the bowels, and for the most part they are amenable to the same treatment.

General Observations.

Symptoms.—In consequence of their movements, the interruption they offer to the progress of the contents of the bowels, and probably other modes of irritation, worms very generally occasion uneasiness or pain in the abdomen, sometimes spasmodic, sometimes described as gnawing or biting, and not unfrequently of a vague indescribable character, and yet very distressing. Sympathetic with this is a sensation of itching at the anus and at the nostrils, producing a disposition to scratch the fundament, and to pick the nose, which is highly characteristic of the verminous affection. The bowels are often disordered, being sometimes constipated and sometimes relaxed, with occasional tenesmus, and mucous or bloody discharges as in dysentery. The mucus is sometimes in shreds or flakes, which are not unfrequently mistaken for fragments of the partially digested worms. It is not uncommon for portions of undigested food to pass with the feces. The appetite is exceedingly variable, in some cases natural, in others deficient, craving, or depraved, one condition not unfrequently alternating with another. The belly is often swollen, hard, and tympanitic, the breath heavy or fetid, and the tongue furred, with a disagreeable taste and a copious flow of saliva. Swellings of the upper lip, bleeding from the nostrils, and a disposition to grind the teeth during sleep, are other characteristic symptoms.

But the effects often extend beyond the alimentary canal, and various derangements of health are experienced in consequence either of the direct irritation of the worms, or of the disordered digestion which they occasion. Among the most common of these are nervous affections; such as fretfulness, irritability of temper, wakefulness or somnolence, disturbed sleep, sudden starting out of sleep as if from fright, vertigo, headache, spasmodic movements of the eyelids, dilated pupils, perverted vision, temporary blindness, tinnitus aurium, and partial deafness. General convulsions are not unfrequent in children, and symptoms strongly resembling those of hydrocephalus have been ascribed to worms, and have ceased on their expulsion. Cases of chorea, melancholy, hypochondriasis, and even insanity have been referred with apparent reason to the same cause. In addition to these affections, may be mentioned obstinate cough, spasm of the glottis, dyspnœa, palpitations, hysteria, menorrhagia, and a general cachectic state of system, marked by a languid circulation, a pale or sallow skin, sunken eyes, a livid circle about the eyelids, and general emaciation, or œdema. A febrile condition occasionally accompanies worms, with daily exacerbations and remissions, a tumid abdomen, offensive breath, and frequently symptoms of cerebral oppression. The name of *worm fever* by which it has been called indicates the prevalent opinion as to its origin. There can be little doubt that worms are capable of producing it; but any other cause which induces protracted intestinal irritation, with disordered digestion, may have the same effect; and there is no such necessary connexion between the fever and the worms as might be inferred from its name.

As to many of the above disordered conditions, it is often impossible to say whether they bear to the worms the relation of cause or effect, and sometimes whether the connexion may not be a mere coincidence. That worms are sometimes the cause, may be inferred from the frequently observed fact, that all the phenomena vanish when they are removed. Again, it is well known that disordered digestion and general debility favour the production of worms; and the same causes which give rise to the developement of these parasites are quite sufficient to produce various derangements by their direct action, wholly independent of the worms; so that the two may coexist without any necessary connexion as cause and effect. Persons in apparently perfect health are occasionally affected with worms, which give no signs of their existence until they are observed in the ordinary passages, or are expelled during some acute attack of disease, either by the medicines employed, or the influence of the disease itself; and it is no uncommon event to find worms in the bowels of individuals after death, who have evinced no signs of them during life. Hence some have inferred that they are generally if not always harmless, and persons have even gone so far as to maintain that they perform a useful office, being intended as scavengers to clear off the noxious matters contained in the bowels. But these opinions are opposed to general experience; and, though it may not be proper to disturb the system of a perfectly healthy individual, supposed to be affected with worms, by active measures for their expulsion; yet, when associated with derangement of health, whether as cause or effect, they should always engage attention, and be removed if possible; as their removal, under such circumstances, is often followed by the best results.

Appearances after death.—Worms are very rarely fatal; but opportunities are often afforded, in cases of death from other causes, to observe the pathological changes they produce in the stomach and bowels. These are very slight, consisting chiefly of an excess of mucus, with occasionally an increased vascularity of the mucous membrane. It has been supposed that worms are capable of piercing the intestine, and escaping through its parietes; as they have sometimes been found engaged in small openings in the coats of the alimentary canal, and even loose in the abdominal cavity. But there is every reason to believe that the openings were the result of previous ulceration, or of changes after death, as in an instance in which great numbers were observed to have escaped through holes in the stomach, which may have been produced by a post-mortem action of the gastric juice. Worms have also been discharged with pus from external abscesses connected with the bowels; but it is most probable that the inflammation which gave rise to the ulcerative and suppurative processes had some other origin than the irritation of the worms. The tricocephalus, however, appears to have the power of inserting its capillary head into the substance of the mucous membrane; and a case is on record, in which the cæcum was found perforated as if with a number of pin holes, and the lining membrane much eroded by worms of this genus. (Brooks, quoted by Farre, in *Tweedie's System of Pract. Med.*)

Causes.—The origin of intestinal worms has been a subject of much controversy. The difficulty of otherwise accounting for their presence in the alimentary canal has led some to the notion of spontaneous or equivocal generation; but, before a mode of production so contrary to the general course of nature can be admitted, it must be clearly shown that their origin from a parent animal is quite impossible. This subject has been already sufficiently discussed in the first part of this work, to which the reader is referred. (See *page* 133.) The conclusion there come to is, that these parasites obey the general laws of animal nature, as well in the mode of their generation, as in that of their developement and growth.

It is probable that the ova, received into the alimentary canal, are capable of developement in a healthy state of this structure, as worms are sometimes found in individuals who are apparently quite free from disease; but, nevertheless, it is certain that their growth is favoured by certain morbid conditions of the stomach and bowels, and particularly by a feeble or disordered state of digestion. Hence, persons of sedentary habits, of scrofulous tendency, and of general depraved health, are apt to be affected with them. It is supposed that an excess of food over the powers of digestion is favourable to their growth. Excessive indulgence of the appetite has, therefore, the same effect as defective digestion. The use of certain articles of food also predisposes to worms, such as crude vegetables, unripe fruits, and indigestible substances in general. Bad bread, spoiled cheese and meats, the flesh of diseased animals, and the use of bad water as drink, are fruitful sources of verminous affections. It is said that they seem sometimes to occur epidemically; but the probability is, that, under these circumstances, a close examination might trace their origin to some impropriety of diet affecting great numbers of individuals; and the same remark is perhaps applicable to the well-ascertained fact, that some regions of country are much more subject to worms than others. Nevertheless, it is not impossible that certain conditions of the atmosphere may favour the production of worms; and it has been observed that they are most abundant in moist countries, and during a long prevalence of warm damp weather. Children, after weaning, and up to about the age of puberty, are more frequently affected with worms than either very young infants or adults, probably owing to the nature of their diet, which is often ill adapted to their yet immature powers of digestion.

Treatment.—Two indications are presented, *first*, to expel the worms from the bowels, and, *secondly*, to prevent their reproduction.

The *first indication* may be fulfilled by active purgatives, which expel them by increasing the peristaltic movement, or by anthelmintic medicines, which favour their expulsion through the ordinary contraction of the bowels, by rendering them less able or less disposed to resist this contraction. But a more effectual plan is to combine these two modes, thus at the same time bringing a greater force to bear upon the worms, and diminishing their powers of resistance. The purgatives and anthelmintics may be given conjointly; or the latter may be administered night and morning for a few days, and then followed by the former.

Anthelmintics are medicines which prove disagreeable to the worms, and thereby dispose them to leave the bowels, or so debilitate them as to disable them from maintaining their position, or destroy their life, and thus expose them to the expulsive powers of the intestines, or the digestive powers of the stomach. They may produce these effects by acting on the susceptibilities of the worm, as medicines and poisons act on the human system, or by mechanically bruising or wounding it. Among those which operate in the former method may be mentioned *pink-root, azedarach, the bark of Andira inermis, male fern, the bark of pomegranate root, koosso, walnut-rind, common salt, camphor, various bitters*, and numerous substances characterized by containing a strongly odorous or highly stimulating volatile oil, as *turpentine, copaiba, savine, chenopodium* or *American wormseed, semen santonicæ* or *European wormseed, tansy, rue, wormwood, garlic*, and *assafetida*. Several of the volatile oils themselves are still more efficacious, especially the *oil of turpentine* and that of *chenopodium*. Electricity passed through the bowels, in successive and somewhat violent shocks, has been supposed to injure or kill the worms, and favour their expulsion by cathartics. The mechanical anthelmintics are chiefly *cowhage*, which wounds and sometimes destroys the worms by the sharp bristles of its pods, and the *powder of tin*, or of *zinc* which bruises or scratches them by its angular particles. *Metallic mercury*, which has been recommended in worms, undoubtedly operates by its great weight. The *fixed oils* are thought by some to act as anthelmintics by covering the surface of the worm, and thus closing its respiratory pores against the entrance of air.

In the choice of purgatives, attention should be paid to their anthelmintic properties. Thus, *calomel* is a powerful vermifuge, much more so than can be satisfactorily explained by a reference to its mere cathartic power. The probability is, that it proves disagreeable or injurious to the worm by the acrid property of the bile which it causes to be secreted. *Aloes* is also thought to possess vermifuge properties, independently of its purgative action, owing to its intense bitterness; this property being considered by some as extremely offensive to worms. The same may be said of *colocynth.* If there is truth in the supposition before alluded to, of the suffocating action of fixed oils on the worms, which, however, is by no means certain, at least in reference to the operation of these oils when taken into the stomach, *castor oil* and *olive oil* ought to be efficacious anthelmintics. The *oil of turpentine* in very large doses, and the *bark of pomegranate root*, unite purgative and anthelmintic powers. Considered independently of anthelmintic properties, those cathartics are the most powerfully vermifuge which act with greatest energy on the muscular coat of the bowels. Senna, jalap, scammony, aloes, black hellebore, cevadilla, colocynth, gamboge, croton oil, and elaterium have been used, variously combined; and in various modes of preparation; but, except in very obstinate cases, it is better to trust to the proper anthelmintics, with the less violent of these cathartics, than to endanger inflammation of the bowels, or exhaustion of the patient, by a resort to the most energetic.

To meet the *second indication*, that, namely, of preventing the reproduction of the worms when once destroyed or evacuated, it is necessary to attend to the food and drink of the patient, and, if the digestion is feeble, to promote that function by tonic medicines, exercise, and other suitable measures. Excess in eating, indigestible substances, unwholesome food of all kinds, and unwholesome drinks should be avoided. Of the tonics, the different preparations of iron are probably the most efficacious; though they may be advantageously combined with the simple bitters, as gentian, quassia, and columbo. The bitters in which the tonic principle is associated with an anthelmintic volatile oil, as wormwood, tansy, and rue, were formerly much used, and are probably not without a peculiar efficacy. When there is acid in the stomach or bowels, lime-water, or one of the alkaline carbonates may be usefully associated with the bitters. The rules applicable to the treatment of dyspepsia may be considered as in force in the present case. Very often, however, after the expulsion of the worms, all unpleasant symptoms cease, and no further treatment is necessary.

1. ROUND WORM.—*Ascaris lumbricoides.*—The round worm generally inhabits the small intestines; but not unfrequently makes its way upward into the stomach, or downward into the rectum; and sometimes escapes from the alimentary canal by the mouth, or by the anus. It occasionally enters other passages which communicate with that canal; having been found in the posterior nares, the trachea, the pancreatic and biliary ducts, and the gall-bladder. It is sometimes solitary; but more generally in considerable numbers; and two hundred have been known to pass from one patient in a week. The worm is supposed to feed upon the intestinal mucus, which is usually copious where these parasites exist. It occurs most frequently in children, occasionally in adults, and seldom in old persons. Of all the different worms that infest the bowels, this is usually considered as by far the most common, and certainly is so with the exception of the tricocephalus.

The symptoms are those already enumerated as resulting from intestinal worms in general. The most characteristic signs are perhaps a tumid abdomen, irregularity of the bowels, depraved appetite, picking of the nose, and grinding of the teeth in sleep. When these worms exist in the stomach, they occasion peculiar deranged sensations in the epigastrium, with nausea, and frequent retching, and motions on the part of the patient as if he were choking from something in the throat, produced probably by attempts of the worm to enter the œsophagus, or by its actual presence in that tube. When these motions occur in an infant, the round worm may be suspected to exist in the stomach. But the only certain proof that a patient is, or has been labouring under this worm, is the sight of it after it has passed from the bowels, or been discharged from the stomach. It sometimes comes away spontaneously from the anus, and is not unfrequently evacuated with the feces, thus affording the requisite evidence of its existence.

The general course of treatment for worms already described is applicable to this species. A good remedy at the commencement, and one which will alone, in a great majority of cases, produce an evacuation of the worms, is an infusion of senna and pink-root, with sulphate of magnesia to correct the griping property of the cathartic, manna to cover the taste, and fennel-seed or other aromatic to correct the flavour, and to render the whole more acceptable to the stomach. This infusion may be given in a small dose once or twice a day, so as to produce two or three evacuations in the twenty-four hours, and may be continued daily, or every other day, for one or two weeks, or even a longer period, if necessary, and it do not too much debilitate the patient.* A little savine may sometimes be advantageously added to the infusion, in obstinate cases. Another good preparation is the officinal fluid extract of spigelia and senna, of which a teaspoonful may be given to a child two or three years old, and repeated as above.

If evidences of deranged biliary secretion are presented, or the bowels are too irritable for the use of the above infusion, or if the infusion has failed, or any difficulty exists in the way of its exhibition, calomel may often be advantageously resorted to. This is, indeed, one of the most efficacious anthelmintics, and has the great advantage, in the cases of children, of easy administration. It is best given in connexion with powdered spigelia, and followed at a proper interval by castor oil. To a child four grains of calomel and sixteen of spigelia may be given at bedtime, followed by a dose of castor oil in the morning; and the remedy may be repeated once and again, if required, at intervals of three or four days. In adults, the calomel and pink-root may be associated with some quicker cathartic, as jalap, scammony, or compound extract of colocynth.

Another plan is to administer, morning and evening, for several successive days, a dose of some anthelmintic, and afterwards a purgative dose of calomel or other cathartic, to expel the debilitated or dead worms. For this purpose, in the case of a child, half a fluidounce or a fluidounce of the officinal infusion of *pink-root*, or from ten to twenty grains of the powder; from twenty to forty grains of powdered *wormseed* (*chenopodium*), or from five to ten drops of the volatile oil; from five to twenty drops of the *oil of turpentine;* or a drachm of an electuary made by incorporating the *bristles of cowhage* with syrup or molasses, may be employed. The oil of turpentine is peculiarly efficacious in stomachic worms, as pointed out by the late Dr. Joseph Klapp, of Philadelphia. In our Southern States, where the *pride of China* (*Melia Azedarach*) grows, the bark of the root of that tree (*Azedarach*, U. S.) is much employed. Four ounces of the fresh bark are boiled with two pints of water down to one, and a tablespoonful is given to a child for a dose. The *cedar apple*, an excrescence upon the branches of the Juniperus Virginiana, or common red cedar, has been highly recommended, in the dose of from ten to twenty grains of the powder, repeated as above mentioned, and will often prove effectual. The above anthelmintics may be employed successively, one of them sometimes succeeding when another has failed.

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* R.—Sennæ, Spigeliæ, āā ℥ss; Magnesiæ Sulphat. ʒij; Mannæ ℥j; Fœniculi ʒij; Aquæ fervent. Oj. To be macerated for two hours in a covered vessel. Dose, for a child two years old, about f℥ss; for an adult f℥iij or f℥iv.

In nervous cases, advantage may result from combining assafetida, garlic, or valerian with the more decided anthelmintics. When the digestion is feeble, the vegetable bitters, or chalybeate preparations should be employed in a similar connexion, and, in cases of the existence of an excess of acid in the stomach or bowels, antacids should also be added. These different remedies may be combined in the liquid form, in that of powder, electuary, or pill, to suit the views of the practitioner, or the convenience of the patient. Care must be taken, after the expulsion of the worms, to provide against their reproduction, as directed in page 654.

2. THREAD-WORM.—*Ascarides.*—*Maw-worm.*—*Ascaris vermicularis.*—The peculiar seat of ascarides is the rectum; but they sometimes also inhabit the colon, and are said to have been occasionally seen in the stomach, and to have derived from this circumstance their name of *maw-worm;* though Dr. Good ascribes the origin of this name rather to the disagreeable sensations they produce in the stomach, from sympathy with the rectum, than to their actual presence in the former viscus. In the female they sometimes enter the vagina, giving rise to severe irritation and intense itching, and even to symptoms of nymphomania. They are usually in great numbers, and multiply very rapidly. Persons of all ages are liable to them; but they are most frequent in children.

Their characteristic symptom is an itching sensation at the anus, which is often distressing and almost insupportable, especially in the evening, and after the patient has become warm in bed. Tenesmus, mucous or bloody discharges, and small tumours about the anus are also among their effects. These local symptoms are in some case all that are exhibited; but the general derangements which have before been described as produced by worms, may proceed also from this species. Disorder of the nervous system is especially apt to occur, from the intense local irritation occasioned by the movements of the worms; and this disorder amounts sometimes in children to general convulsions. But this irritation of the anus may proceed from other causes, and the only certain evidence of the existence of ascarides in the rectum is afforded by their occasional appearance upon the bed-clothes, or in the stools. They not unfrequently make their way out of the rectum during the night, and may be seen upon the sheets in the morning; and are sometimes discharged in considerable numbers, either mixed with the feces, or enveloped in mucus, or clustered together in the form of a ball. It is extremely difficult completely to dislodge them from the bowels; for, however great the numbers evacuated, or the temporary relief obtained, a few generally remain, and, by the rapidity of their propagation, reproduce all the original symptoms. Though productive of great inconvenience, and even suffering, they may exist for many years without serious injury to the health, and have been known to continue through almost the whole of a long life, without reason to suppose that they had in any degree shortened it. (Heberden, *Trans. of the Col. of Phys., Lond.*, i. 54.)

Treatment.—Medicines taken by the mouth are usually less efficacious in this than the other species of worms. The most successful plan is to address the remedies immediately to the rectum, and, having weakened or destroyed the worms by anthelmintic enemata, then to procure their expulsion by cathartics taken in the ordinary way, or thrown into the bowels. The substances most advantageously employed in enemata, are oil of turpentine, aloes, common salt, decoction of rue or wormwood, infusion of tobacco, sulphuretted waters, the alkaline sulphurets, tincture of chloride of iron, chloride of soda, and vinegar. Great advantage is said to have resulted from an infusion of quassia made in the proportion of two drachms to four fluidounces of water. (*Gaz. des Hopitaux*, Sept. 1846.) Some one of these, or some combination of them, should be injected daily, with a sufficient quantity of water, and after several days should be followed by a dose of calomel or aloes, or other brisk cathartic. A dose of sulphur, taken every morning before breakfast, has been found very useful. Advantage has also been derived from the introduction into the rectum of a bougie smeared with mercurial ointment, or of a candle or piece of fat pork tied to a string, which, after having been allowed to remain for some time, is withdrawn with the worms adhering to it. In adults, much relief may sometimes be obtained by the greased finger employed in like manner. Injections of olive oil or other mild fixed oil, and the external application of creasote incorporated with some unctuous matter, have been recommended as palliative measures. The frequent local use of cold water also allays the itching. It is advised to avoid exposure to heat, or the use of stimulating articles of food. When the worms have found their way into the vagina, injections of cold water with vinegar are recommended by Bremser. The general health should be attended to as in the other kinds of worms. It is asserted that the change of system which takes place at puberty is unfavourable to the existence of these worms, which often cease to appear after that period.

3. LONG THREAD-WORM.—*Tricocephalus dispar.*—This worm is found most frequently in the cæcum or other part of the colon, but sometimes also in the small intestines, either loose, or with its anterior capillary portion inserted into the mucous membrane. It is often observed, in great numbers, in the bodies of individuals who have died suddenly, by accident or from some acute disease, and who have exhibited no evidence of its existence during life. The tricocephalus was first noticed as a distinct worm in Germany, in the year 1760, and has since generally been considered as very rare. The fact, however, appears to be, that it is very common, perhaps the most so of all the intestinal parasites; but has escaped notice in consequence of its minuteness, or been confounded with the ascaris vermicularis. It is stated in the *London Medico-Chirurgical Transactions* (vol: xxii. p. 285), that, in the London Hospital, during one winter, this worm was found in almost all the bodies carefully examined, whether of persons destroyed by injuries, or of those who had died of disease. It does not appear that there are any peculiar symptoms which indicate its existence, or that any special course of treatment is to be pursued. Should the ordinary signs of worms be present, the remedies adapted to the round worm may be employed.

4. COMMON TAPE-WORM.—*Tænia solum.*—BROAD TAPE-WORM.—*Bothriocephalus latus.*—*Tænia lata.*—Between these two worms there seems to be no such difference in their habits, residence, symptoms, or treatment, as to require a distinct practical consideration. The following observations may, therefore, be considered as applicable to both kinds. The bothriocephalus, or broad tape-worm, is said to be found only among the inhabitants of Switzerland, Poland, and Russia, or in individuals who have been in those regions; the tænia, or common tape-worm, is met with everywhere.

They inhabit chiefly the small intestines; and are often solitary, but sometimes also in numbers, though less numerous than the other intestinal worms. They occur during childhood, but more frequently after puberty, and are very rare in old age. Females are more subject to them than males. They are much more common in some countries than in others, and are comparatively rare in the United States, at least within the limits of my observation. Perhaps this result may be ascribed to the abundance of wholesome food within reach of everybody in this country. Tape-worms often exist in large and tangled bunches, so as to interfere mechanically with the proper performance of the intestinal functions.

It is affirmed that the tænia and bothriocephalus cannot propagate in the human intestines through their eggs, and require to be transplanted to another animal in order to become reproductive; so that, if the worm can be wholly expelled, there is no danger of an increase from its eggs deposited in the bowels. (See *Archives Gén.*, 4e sér., xxix. 206.)

Symptoms.—In some instances, the tape-worm has long existed in the bowels without producing any very prominent symptoms; but it generally occasions great discomfort, and sometimes materially deranges the health. There is not often perhaps very acute pain; but the sensations experienced are scarcely less distressing than pain, and are often attended with great depression of spirits or irritability of temper. These sensations are referred to the movements of the worm. Professor Wawruch, of Vienna, who during a period of twenty years had witnessed 206 cases of tape-worm, gives the following summary of the symptoms:—Dull pain in the forehead; giddiness; buzzing in the ears; dulness of the eyes, which are surrounded by a dark circle; edematous eyelids; dilated pupils; frequent and spasmodic movements of the eyes; alternate paleness and flushing of the face; paleness of the lips; peculiar movements of the nose and mouth; emaciation; alternate loss and excess of appetite; cravings for particular articles of food; offensive breath; furred tongue; spitting and vomiting of thin mucus in the mornings; itching at the nose, anus, and vulva; grinding of the teeth, especially during sleep; constriction of the throat; swelling of the belly; gurgling, shooting pains, and a sense of pinching about the umbilicus; a feeling in the morning as of a foreign body moving in the bowels; amelioration of all the symptoms under the use of farinaceous food, hot bread, and coffee; finally, depression of spirits, and a train of nervous derangements in protracted cases. (*Archives Générales*, 4e sér., i. 208, from *Oesterrich. Med. Jahrbuch*, 1841, No. 2.) Sometimes the nervous disturbance amounts to convulsive movements, of an epileptiform or hysterical character, and when these occur in a man, with signs of abdominal disorder, the possible existence of the worm should be suspected, and an investigation of the evacuations made. The most certain sign is the discharge of joints of the worm, which are either passed alone or with the stools. These joints usually exhibit signs of life when they first appear, and have been supposed to possess the power of independent existence, and even of propagation; but this is denied by the best authorities.

Treatment.—Tape-worms have the power of retaining their place very tenaciously in the bowels, possibly in consequence of holding on to the mucous coat by means of suction. They often continue for years to harass the patient, who passes from time to time separated joints, or even large portions of the worm, without getting entirely rid of the troublesome parasite. The duration of the affection, according to the observation of Wawruch, varies from a few months to thirty-five years. It is considered important that the head of the worm should be expelled; as, until this happens, there is no certainty that the evil has ceased. Many different plans of treatment have been employed with asserted success; most of them including active purgation, and the use of substances calculated to injure or destroy the worm. Whatever method of cure is followed, much pain is often experienced by the patient just before the expulsion of the worm, which is ascribed to the violent movements of the animal, under the influence of the medicine. It is deemed best to prepare the patient by a somewhat restricted diet upon the day preceding the use of the medicine, which should be given in the morning upon an empty stomach. By some it is even advised to precede the anthelmintic, for four or five days, by a spare diet, consisting chiefly of liquids, and by the use of saline or other laxatives, so as to leave the worm with as little protection as possible from the alvine contents, against the influence of the active purgatives, or the anthelmintics, which may be given for its expulsion. The following remedies are those which have attracted most notice.

The medicine at present probably most relied on is the *oil of turpentine.* This is given in large doses, and very often with the speediest and happiest effects. The quantity administered at once varies from half a fluidounce to two fluidounces, and much exceeds the dose of the medicine for ordinary purposes. But, in this large dose, the oil is thought to be less apt to produce constitutional disturbance or irritation of the kidneys; because, acting as a cathartic, it is less apt to be absorbed. The only inconveniences usually experienced are heat of stomach, some general febrile excitement, and a sense of fulness in the head; but sometimes it causes headache, vertigo, a kind of intoxication or delirium, drowsiness, &c.; and these effects will occasionally continue for several days. They are most apt to follow when the medicine fails to act as a cathartic. The oil usually operates quickly upon the bowels, and brings the worm or portions of it away dead along with it. The caution, however, should always be observed, if it do not purge in the course of two or three hours, to administer a full dose of castor oil, and to aid the action of the medicine, if necessary, by enemata. A good plan, in order to insure the cathartic action, is to give the two oils conjointly, half a fluidounce of the oil of turpentine being mixed with an ounce of castor oil, and the dose repeated in a few hours if it should fail to operate. Olive oil has been recommended as a substitute for castor oil, in double the dose; but it is not to be relied on. Croton oil has sometimes been given after the oil of turpentine; but, though powerful, it adds unnecessarily to the intestinal irritation. In order to obviate such irritation, it is recommended that the patient drink freely of broths or mucilaginous liquids during the use of the oil. This may be administered in milk, coffee, or some one of the aromatic waters.

From the statement of Dr. Knox, who had the opportunity of treating numerous cases of tape-worm among the British troops at the Cape of Good Hope, it appears that the large doses of oil of turpentine above mentioned are not essential. He found that a drachm or two of the oil, given with a little water, morning and evening, for three days successively, was generally sufficient to destroy the worm, even in the most obstinate cases, and to cause its discharge from the bowels without the aid of purgatives; though the administration of a little castor oil, each day about noon, was deemed advisable. (See *N. American Med. and Surg. Journ.*, ii. 116.) The success said to have attended upon the use of small and repeated doses of Venice turpentine, which depends for its virtues upon the volatile oil, is confirmatory of the statement of Dr. Knox. (*Hufeland's Journal*, June, 1826.)

A preparation known by the name of *Chabert's empyreumatic oil*, which obtained great reputation on the continent of Europe in the cure of tænia, owes its efficacy, in all probability, chiefly to the oil of turpentine which it contains. It is prepared by mixing together three parts of oil of turpentine and one of the empyreumatic oil of hartshorn, allowing the mixture to stand for four days, and then distilling off three-quarters of it by means of a sand-bath. The liquid should be kept in small and well-stopped bottles; as it is injured by exposure. Bremser found it a most efficacious remedy in tape-worm, having effected cures with it in more than five hundred cases. His treatment consisted in first evacuating the bowels by means of a purgative electuary, afterwards administering two teaspoonfuls of the oil in a little water, morning and evening, for several days, until about three ounces had been used, then interposing a purgative, and finally resuming the oil as at first until the cure was completed. From four to six ounces altogether are required for this purpose. Under the action of this remedy, the worm is thought by Bremser to be destroyed, and to undergo partial digestion, so that it does not come away whole from the bowels, and sometimes is not discoverable in the evacuations, though the cessation of the symptoms proves the efficacy of the medicine. The oil is very nauseous, and aromatic additions should be made to cover its flavour.

Much published testimony exists in favour of the *bark of pomegranate root*. The fact that a living tape-worm, introduced into a decoction of the bark, immediately evinces great suffering by its writhings and contortions, and dies in the course of five minutes, while it is capable of living several hours in pure water, is a proof that the bark is poisonous to the animal. The remedy may be administered in powder or decoction; but the latter form is usually preferred. Two ounces of the bruised bark are macerated in a quart of water for twenty-four hours, and the mixture then boiled down to a pint. A wineglassful is to be given every half-hour, hour, or two hours, until the whole is taken, or a powerful action is produced. The remedy often occasions nausea and vomiting, and generally purges, and the worm comes away with the stools. It is recommended to diet the patient strictly, and give a dose of castor oil on the preceding day, and, if the decoction should not purge, to follow it with castor oil or an enema. Should the worm not be discharged at the first trial, it is recommended to repeat the remedy daily for three or four days, or until the desired effect is obtained.

The *root of the male fern* is also a remedy which has enjoyed great reputation in the treatment of tape-worm. The reports in its favour are too numerous to admit of a reasonable doubt of its efficacy; but the dried root as found in our shops is probably in general nearly or quite inert, in consequence of long keeping; and the remedy, therefore, has obtained little credit in this country as a vermifuge. It is given in powder, or in the form of ethereal extract, sometimes called oil of fern. The dose of the former is from one to three drachms, of the latter from twenty to thirty grains, to be given in the form of electuary, and repeated morning and evening for a day or two. It is customary to follow the root by some brisk cathartic.

An Abyssinian product called *koosso* has recently attracted much attention as a remedy for tape-worm; and, from the numerous reports in its favour, there can be no doubt of its great efficacy. It consists of the flowers of a tree, and is administered in the form of powder, of which half an ounce is mixed with half a pint of warm water, and given in two or three draughts at short intervals, in the morning, on an empty stomach. Should the medicine not operate in three or four hours, it should be followed by a brisk cathartic. For further particulars in relation to it, the reader is referred to the U. S. Dispensatory.

Dr. Küchenmeister has performed some interesting experiments to ascertain the relative poisonous power over the two kinds of tape-worm, out of the body, of the different anthelmintics above mentioned, with the following result. A decoction of the koosso in milk destroyed the worm in half an hour; oil of turpentine mixed with the white of eggs in an hour and a half; root of the pomegranate in three hours and a half; and the ethereal extract of the male fern in four hours. (*Arch. Gén.*, 4e sér., xxix. 205.)

Tin and *Zinc*, granulated or in filings, have been occasionally employed with success. In order that the worms may be exposed unprotected to their mechanical action, they should be preceded by a cathartic. The dose is somewhat indefinite. Dr. Alston, beginning with an ounce in the morning on an empty stomach, administered half an ounce on each of the two succeeding days, and closed with an active purgative.

Many cases have recently been reported in the journals in which *pumpkin seeds* have been used successfully. The dose is about two ounces, which should be taken in the morning, fasting, and followed in an hour or two by a dose of castor oil. They may be taken beaten into a paste, or in the form of emulsion.

Various other remedies have been recommended. Schmucker employed powdered *cevadilla* in the dose of half a drachm daily, or half the quantity twice a day, interposing an occasional purge. *Mare's milk* is asserted to have been used with great advantage in Germany. Hufeland associated a decoction of *garlic* in milk with castor oil and tin filings. Wawruch used *salicin* in doses of from two to six grains every two hours, with advantage in some cases. Dr. S. Jackson, late of Northumberland, showed the author a portion of tape-worm (*Tænia solium*) thirty feet long, which had been discharged by a female patient of his, upon taking a dose of castor oil, after having been, for two months, upon the use of half a fluidounce of *olive oil*, night and morning, to obviate constipation. Mr. Whittel has found *oxide of silver*, in the dose of a grain, repeated occasionally, effectual in two cases. Sometimes a portion of an unbroken worm passes out through the anus, while the remainder continues within the bowels. Caution is here requisite not to break the worm in attempting to extract it. Brera recommends that it should be tied with a piece of silk. When thus treated, though the worm may draw itself within the bowel, it begins to descend again not long afterwards. Dr. Cagnola proposed to touch the extruded portion with hydrocyanic acid, in the expectation that this poison would destroy the worm; and the experiment was successfully tried by Dr. Garleke. Caution, however, would be requisite not to incur the risk of injuring the patient. Dr. Frank, of St. Petersburg, succeeded in withdrawing the tænia whole, by passing the part without the bowel through a canula, and introducing this into the rectum, so as to overcome the resistance of the sphincter ani.

Article VII.

STRICTURE OF THE RECTUM.

The existence of stricture of the rectum may be suspected when there is difficulty in the evacuation of the bowels, with straining, and the discharge of the feces in portions of diminished size and altered shape, either flattened like ribbons, or in worm-like cylinders, straight or spirally twisted, or in small distinct lumps. If an examination be now made, and resistance offered to the passage of the finger or a large bougie up the rectum, the suspicion will be confirmed. The stricture may depend on thickening or other organic derangement of the coats of the bowels, or upon spasmodic muscular contraction. These two conditions require a separate consideration.

1. *Organic Stricture.*—In this form, which is the most frequent, the difficulty of expelling the feces comes on almost imperceptibly, and increases gradually, until it becomes a source of great inconvenience. When the affection is considerably advanced, there is usually obstinate constipation, with

severe and painful efforts to procure evacuations, and often nothing for some time but bloody or mucous passages; though occasionally, from the irritation produced by purgatives, or by the accumulated fecal matter, a looseness sets in which yields temporary relief. All the morbid effects enumerated under the head of constipation are experienced in this affection. The stricture may remain for an indefinite time in this condition, or it may go on increasing until the passage is nearly or quite closed, and positive obstruction ensues. (See *Obstruction of the Bowels.*) Death is now inevitable unless from the interference of art, or unless nature, as sometimes happens, creates a new opening for the escape of the feces by means of ulceration.

The organic derangement which constitutes the stricture may be of a carcinomatous character, or it may be entirely destitute of malignancy; and it is important that the two states should be properly distinguished; as the means which may be found useful in the one, are generally useless if not injurious in the other.

In the *carcinomatous* or *cancerous* stricture, there is severe lancinating pain, which usually extends down the thighs; and the part affected, if in the scirrhous state, is usually unequal to the touch, and of an almost cartilaginous hardness. In the advanced stages, after ulceration has commenced, there is an ichorous discharge of an offensive and peculiar odour, characteristic of cancer wherever met with, and occasional exhausting hemorrhages. To the finger the diseased structure now offers ulcerated surfaces, with hard inverted or everted edges, and prominent friable granulations. The patient has also in general a peculiar cachectic aspect, with a pale waxen or leaden skin, œdema of the extremities, and a very painful and wan expression of countenance, consequent upon his protracted sufferings. When the complaint is beyond the reach of the finger, it may, for the most part, be recognized by the odour of the sanious stools, the lancinating and persevering pains, and the cachectic appearance just alluded to. The disease sometimes affects a small portion of the bowel, occupying either one side or the whole circumference, or more rarely projecting in the form of a tumour into the cavity. In other instances, it extends over a large portion or the whole of the rectum, which is unequally thickened and hardened, with a small winding passage through it, and offering to the finger nothing but hard tubercles, or bleeding friable ulcers. Cancer of the rectum is not uniformly attended with obstinate constipation; and the degree of this affection varies with the extent and position of the induration, being greater when the whole circumference of the bowel is affected, than when the disease occupies only one side of it. In the ulcerative stage, instead of constipation there is often an exhausting diarrhœa. In the carcinomatous stricture art can afford little relief. Bougies and caustics have sometimes been employed to open or enlarge the passage; but they are justifiable only when the danger of death from obstruction is imminent. The same may be said of the attempts to break or tear away portions of the diseased mass, which have been resorted to for a similar purpose. The only chance of cure is afforded by the extirpation of the diseased structure, which is very rarely possible, without great danger. Scirrhus occupying only the anal extremity has sometimes been successfully removed by the knife, and tumours supposed to be scirrhous have been separated by a ligature.

The *ordinary, non-malignant, organic stricture* is distinguished by the absence of the symptoms above described as characteristic of the cancerous. It usually depends upon a thickening of the submucous cellular tissue, consequent probably upon inflammation. This may occupy a considerable extent of the bowel, and its whole circumference, or may be confined to a small part of it, and to one side. Sometimes it consists of a sort of crescentic cord, projecting from the side of the rectum, sometimes of a partition extending in a greater or less degree across it, and again of a transverse network of filaments. It may be seated in any part of the bowel, but is most commonly found about two or three inches above the anus. Instances have occurred in which the feces, accumulated above the stricture, have by their pressure produced ulceration, and thus made their way outward by a new passage. Such a passage has been made around the stricture into the portion of the bowel beneath it, into the bladder, and into the vagina; the feces escaping in the first case per anum, in the second with the urine, and in the third from the vulva. In such instances, the relief obtained is usually but temporary; the patient being at length worn out by the continued irritation and discharge.

Anything may operate as a cause of this stricture, which is capable of producing chronic inflammation in the coats of the bowel. It is occasionally, perhaps, ascribable to venereal infection. Polypus of the rectum may produce the symptoms of stricture; but the affection is so purely surgical that I shall not treat of it here.

Stricture is in general amenable to treatment. The passages should be kept soft and unirritating by a proper attention to diet, and by the use of laxatives, especially those of a saline character. But the chief means of cure consists in the use of the bougie, which should be introduced daily, and gradually increased in size as the passage becomes enlarged. In some instances, the bistoury may be advantageously resorted to, especially when the stricture consists of a thin partition, and the symptoms of obstruction are threatening. In the circular stricture, which is usually seated about one-quarter or one-third of an inch above the anus, M. Robert prefers the use of the Vienna caustic (potassa with lime), which may be applied by means of a speculum. (See *Am. Journ. of Med. Sci.*, N. S., xix. 512.) In cases where there is no alternative between death and the formation of an artificial anus, it is recommended by Amussat to make an opening into the colon, on the left side posteriorly, where it is not covered by the peritoneum; and the operation has been performed with success. (*Dict. de Méd.*, xxvii. 303.)

2. *Spasmodic Stricture of the Rectum.*—In this form of stricture there is the same difficulty in evacuating the bowels, and the same lessened dimensions, and altered shape of the fecal cylinder; but these symptoms are not constant; and the feces will occasionally be found of the natural size. One of the characteristic signs is a feeling of constriction before or at the time of going to stool, and an occasional severe spasmodic pain, especially upon the application of an irritant. The introduction of a bougie will be resisted at one time, while at another, the instrument may pass with little or no difficulty. The stricture sometimes exists at the anal extremity of the rectum, depending on a spasmodic contraction of the internal or external sphincter, or both. It is then characterized by great difficulty in introducing the finger or an instrument through the anus, while, above the internal sphincter, the bowel may be quite relaxed. There is the same difficulty in passing the feces as in the other cases; and, after the evacuation, the patient experiences considerable pain for some time. From the great straining, the affection is apt to be attended with hemorrhoidal tumours. Spasmodic stricture is more apt to attack the young than the old, and is not commonly attended with that cachectic aspect, or general failure of health, which frequently marks the permanent organic affection.

This form of stricture may result from a peculiar irritability of the rectum; from disorder in the spinal marrow, or neighbouring pelvic viscera which may radiate irritation to this bowel; or from a morbid excitability of the nervous system in general, such as occurs in hysterical or hypochondriacal individuals.

The exciting cause may be anything capable of directly irritating the rectum, as hardened feces, vitiated bile, or acid in the bowels; or, in cases dependent upon the state of the general health, anything calculated to produce disorder in the nervous functions.

The indications in the treatment are, 1. to remove or prevent sources of direct irritation to the rectum; 2. to produce a relaxation of the spasm; 3. to diminish the morbid irritability of the bowel; 4. to remove any existing spinal disorder, and 5. to correct the morbid condition of the nervous system when this is in fault. To meet the first indication, the feces should be kept in a soft state by the use of a mild laxative diet, aided, if necessary, by the most unirritating laxative medicines, such as sulphur and the saline aperients; the biliary secretion, if deranged, should be corrected, and acid in the bowels neutralized; and all acrid or drastic cathartics, and especially aloes, should be carefully avoided. To produce relaxation of the spasm, recourse may be had to enemata of opium, belladonna, camphor, assafetida, and cold water, and to the use of the warm bath or semicupium. The bougie, frequently introduced, will sometimes be found useful by diminishing the irritability of the rectum; but, if this condition be connected with inflammation, leeches to the anus will be a more appropriate remedy. Spinal disorder should be encountered by leeches, and rubefacient, vesicatory, or pustulating applications. Finally, the morbid state of the nervous system is to be corrected by tonics, exercise, a regulated diet, proper mental occupation, and the occasional use of the nervous stimulants, as valerian and assafetida. In women, attention should be paid to the condition of the uterus, as disorder of this organ may operate injuriously upon the affection, not only by deranging the condition of the nervous system generally, but by transmitting a sympathetic irritation directly to the rectum; and the same remark is applicable to diseases of the genital organs in men, and of the urinary apparatus in both sexes.

Article VIII.

HEMORRHOIDS, or PILES.

This term has been applied both to hemorrhages from the rectum, and to certain tumours which form in and about the anus. In the former case, whether the hemorrhage is or is not accompanied with tumours, the affection is called *bleeding piles;* in the latter, when unconnected with any discharge, *blind piles.* The tumours are also distinguished into *internal piles,* which are within the sphincter ani, and *external piles,* which are without the sphincter. I shall pay little attention to these distinctions in the following remarks. Simple bleeding from the rectum, independent of tumours, though it may proceed from the same pathological condition as that which gives rise to the tumours, falls properly among the hemorrhages, and will be considered with them. I shall here speak of the hemorrhage only as an attendant or result of the tumours.

Two distinct ingredients often enter into the composition of the hemorrhoidal disease; 1. a peculiar constitutional disturbance which determines irritation and congestion of the rectum, and 2. tumours at the extremity of the bowel. The two may exist separately—the former occasionally running its course without resulting in tumours, the latter often originating in purely local causes; but they are very generally more or less associated. I distinguish the one by the name of the *hemorrhoidal effort,* the latter by that of hemorrhoidal tumours, or simply *hemorrhoids.*

The *hemorrhoidal effort* is frequently marked by certain symptoms of constitutional disorder, preceding or attending those of irritation or congestion of the rectum. Of the former are general uneasiness, mental dejection, or irritability, languor, uncomfortable sensations in the head, pain in the loins, dyspeptic feelings, constipation, and colicky pains; of the latter, a feeling of weight or tension in the region of the sacrum, heat about the anus, sometimes pains in these parts extending to the neighbouring pelvic viscera and to the lower extremities, a sensation of fulness in the lower portion of the rectum, and a disposition to go to stool, with little or no evacuation. This condition continues for three or four days, and then subsides spontaneously, or under treatment, to return under various excitements, and sometimes periodically, without any known cause, at intervals of weeks, months, or years. It is sometimes relieved by hemorrhage, sometimes passes off without either this, or the production of hemorrhoidal swellings, but most frequently either accompanies or produces tumours, and, if these have existed previously, provokes them into irritation or inflammation.

Hemorrhoidal tumours are not entirely identical in character. The following varieties may be distinguished. 1. The simplest form is that of *varicose hemorrhoidal veins*, consisting in a mere distension of the coats of the vessel, as in varicose veins of the leg. The same vessels are affected in the external and the internal piles, the veins above and below the sphincter being continuous, and not suffering dilatation in general at the sphincter, because compressed by that muscle. In their simplest state, these tumours are full of liquid blood, and may be readily evacuated by pressure, to be filled again immediately upon the removal of the pressure. After death they frequently disappear entirely, but may be rendered evident by injecting the inferior mesenteric vein. 2. The varicose tumours, in consequence of inflammation, or from rupture and resulting effusion of blood, undergo various changes. By inflammation their coats are thickened, coagulable lymph is effused into the neighbouring tissue, with which adhesions are contracted, the communication between the varix and the venous trunk is closed, and the blood within coagulates. By rupture, the blood escapes, and, being diffused in the cellular tissue, or forming a distinct cavity for itself either in the substance of the tissue, or between it and the mucous membrane, coagulates, and excites inflammation and consequent effusion of lymph in the contiguous parts. In either of these cases, a *solid, vascular, hard*, or *more or less spongy tumour* results, which, upon being opened, often discloses a clot of blood in its centre, thus showing its mode of production. 3. Instead of being varicose, the tumours sometimes consist of a sort of *erectile tissue*, which may be supposed to be formed by the opening of communications between contiguous venous and perhaps arterial radicals, and between both and the cellular tissue, which assumes a denser and firmer character, exhibiting numerous interlacing fibres. 4. *Fleshy tumours* may originate from the altered varices described above, by the organization of the coagulated blood in their centre, or its absorption and the deposition of organizable lymph. Or they may be produced, as Burne suggests, by a circumscribed thickening of the submucous cellular tissue, which, thus projecting somewhat into the cavity of the rectum, is carried down during defecation, and, being arrested by the contraction of the sphincter, becomes inflamed and enlarged, so as not to admit of return. 5. Tumours formed in any of the above modes may, by the influence of adhesive inflammation and subsequent absorption, be converted into *dry, hard, indolent, wart-like projections* in or near the anus; and, even though originating under the mucous membrane, may be covered with skin, in consequence of a not unfrequent transformation of that membrane, when prolapsed and exposed long to the air. Another sequela of the proper hemorrhoids consists in *folds of the mucous membrane* or *skin* in or near the anus, resulting from the absorption of the contents of previous tumours.

Symptoms and Course of Hemorrhoids.—The patient experiences a feeling of heat, fulness, and dull pain about the sacrum and anus, radiating more or less to surrounding parts. This continues for a few days, disappears, and again returns; and the event may occur several times without attracting much attention. At length the patient becomes conscious of a swelling, or a sensation as if a foreign body were in the anus or above it, and, applying his finger after an evacuation, discovers a small tumour of the size of a pea or larger, which either remains perceptible or retires, according as it originated without or within the sphincter. In other instances, the tumour appears to be formed suddenly in consequence of severe straining at stool. It is covered by the mucous membrane of the rectum, or, if external, partly by this and partly by the neighbouring skin, which is generally movable over it. The little tumour gradually increases; others form around it, occasionally clustering like a bunch of grapes; and a mass at length results, often as large as a pigeon's egg, and sometimes much larger. The progress, however, of the tumour is not uniform. During the periods of hemorrhoidal congestion, it increases most rapidly, acquiring an augmented volume at each successive period, though diminishing and sometimes almost disappearing in the intervals. In its ordinary uninflamed state, the tumour has little sensibility, but, when inflamed or strangulated by the sphincter, it becomes the seat of burning, stinging and otherwise very painful sensations, is often exquisitely tender to the touch, and renders defecation difficult, and sometimes exceedingly distressing. Shooting pains extend from it to the back, down the thighs, and to the viscera of the pelvis; irritation is sometimes radiated to the prostate gland, bladder, and uterus; and difficult micturition is not unfrequently produced. Sometimes the patient can neither stand, walk, nor sit with comfort, and finds the horizontal position the only one tolerable.

The phenomena of piles are somewhat different, according as they are external or internal. In the external piles, a tumour is observed on the verge of the anus, of greater or less extent, sometimes on one side only of the aperture, sometimes completely surrounding it, and in the latter case usually presenting an unequal outline, as if consisting of several tumours separated by shallow furrows. The consistence and colour of the tumour vary according to its character. If varicose, it is of a violet colour, soft, and more or less removable by pressure; if fleshy, it is of a red colour, solid, firm, and elastic. It has usually a broad base; and the fleshy tumour is often elongated from before backward, in consequence of being pressed on each side by the buttocks. When inflamed, these piles are peculiarly inconvenient by interfering with exercise in almost every way, and even with sitting. The internal piles are attended with a sense of distension which provokes a constant disposition to go to stool, and are peculiarly painful during the act of defecation. At first, though they are apt to descend at each evacuation, they usually return spontaneously when the straining ceases; but, after having acquired a certain magnitude, they can be restored to their position within the sphincter, after protrusion, only by the aid of the finger of the patient. When without the sphincter, they are rendered very painful by its contraction, but become comparatively easy when returned. After a time they descend when the patient walks or stands, especially if the rectum is full, and great inconvenience is experienced from the irritation and excoriation to which they are subjected. When thus extruded, they are sometimes strangulated by the sphincter, and become in consequence so much inflamed and swollen, that the patient cannot himself restore them, and even the surgeon finds considerable difficulty. Occasionally, in this condition, they burst, and by the discharge of blood are so much diminished in size, and relieved, as to admit of easy reduction. In other cases, they swell enormously, become gangrenous, and, after having occasioned vast suffering and inconvenience to the patient, slough off, and terminate finally in a radical cure. There are the same differences in colour and consistence in the internal as in the external piles. The fleshy tumours are sometimes narrow at the base, and bear no inconsiderable resemblance to polypi of the rectum.

Both the internal and external piles occasionally suppurate, forming abscesses or ulcers which are often very troublesome, ending sometimes in the establishment of fistulæ, though in other cases they eventuate more favourably, and even lead to a permanent cure.

More or less hemorrhage often attends defecation, the blood proceeding either from the abraded mucous coat, or from a rupture of the tumour, or from an oozing over its whole surface in an inflamed state. In general the bleeding is very slight, not more than sufficient to tinge the feces. But it is sometimes copious, and, in a few comparatively rare cases, very much so, producing by its frequent returns, and the quantity discharged at each time, an alarming and dangerous anemic condition of the patient. Some individuals are liable to periodical attacks of this hemorrhage, corresponding probably with the periodical returns of the hemorrhoidal congestion; and it is not always easy to decide, whether the bleeding is or is not connected with the tumours. The blood sometimes collects in large quantities in the rectum before being discharged. It is in some instances venous, in others arterial; being of the former character probably when proceeding from a ruptured tumour, and of the latter when from other sources.

During the discharge of the feces, fissures are sometimes produced in the mucous coat around the anus, which afterwards bleed at each evacuation, and become occasionally so tender as to render the act of defecation almost insupportable.

In consequence of chronic inflammation of the hemorrhoidal tumours, and of the neighbouring mucous membrane, a discharge of whitish mucus sometimes occurs, which was formerly distinguished by the name of *white piles*, or *anal leucorrhœa*.

Among the local consequences of piles is sometimes a thickening of the lower part of the rectum, resulting from repeated inflammation, which forms a sort of stricture, and very much interferes with the discharge of the feces.

The general health often suffers much from long-continued and aggravated piles. Preventing exercise, and rendering necessary an almost constant use of medicines which interfere more or less with digestion, they lead to the production of dyspepsia with its train of evils, and, besides, call various organs into a direct sympathy, which cannot but impair their functions. Paleness, emaciation, and mental irritability or dejection, or at least a very uncertain condition of the feelings, are among their frequent concomitants; and dropsy sometimes results from the anemic state of the blood.

Diagnosis.—The complaints with which piles are most likely to be confounded, are polypus of the rectum, and prolapsus ani. It is, however, only the solid and firm hemorrhoidal tumours that resemble polypus. They may be distinguished by the firmer consistence of polypus, and by its gradual and steady developement, without the periodical congestions, and alternate increase and diminution which characterize piles. The latter, moreover, generally have a broad base, while the polypus is joined to the mucous membrane by a sort of peduncle; but this is not a certain criterion; as the two conditions are sometimes reversed. Piles are usually distinguishable from prolapsus by their colour, their distension and compressibility, and their greater or less irregularity, even when forming a ring about the anus. Syphilitic tumours may sometimes be confounded with fleshy piles; but they differ in the circumstances of their origin, and in their uninterrupted progress.

Causes.—These are such as either produce congestion in the rectum, or act with an immediate mechanical violence upon its lower extremity. The former may be constitutional or local. Among the constitutional, the most common is probably a plethoric state of the blood-vessels, induced by a rich, nutritious, and stimulating diet, or simple excess in eating, conjoined with sedentary habits. Gouty and rheumatic irritation, sometimes shows itself in a congested state of the hemorrhoidal vessels. The suppression of habitual discharges, such as that of the menses, sometimes leads to the same result. Hereditary predisposition has also been considered as one of the remote causes of piles, and there can be little doubt that a peculiarity of constitution favourable to this disease occasionally descends from the parent to the offspring. Of the local causes, those are most efficient which by any means tend to check the return of blood from the hemorrhoidal veins. Torpidity and congestion of the liver often occasion piles, by impeding the return of the blood of the portal circulation through the capillaries of that organ; and hepatic induration or enlargement may have the same effect, either in the same way, or by narrowing the ascending vena cava. Pregnancy, and a long continuance in the erect position, the former by mechanical pressure upon the returning veins, the latter by the effect of gravitation, often cause a distension of the hemorrhoidal vessels that results in piles. To the above list may be added all causes of irritation of the rectum, whether direct or indirect, such as acrid purgatives and especially aloes, irritating injections, the frequent use of suppositories, acrid alvine evacuations, ascarides, violent jolting on horseback, dysentery, inflammation of the prostate or of any of the pelvic viscera, and venereal excesses. The causes which act by mechanical violence are long and severe straining at stool, and the difficult passage of hard fecal matter through the anus. But piles probably have their origin more frequently in constipation of the bowels than in any other source. This operates in various ways in producing them, but chiefly by the pressure of the accumulated and hardened feces upon the returning veins, and by the straining, violent compression, irritation, and even laceration they occasion during their evacuation.

Piles are very rare before the age of puberty, and are most common between the thirtieth and fiftieth year. Males are more subject to them than females, if we except pregnant women, in whom they are very frequent.

Treatment.—In relation to the treatment of piles, it is proper first to consider what effect their cure may have upon the general health, and how far we may venture upon their removal with safety. They have been considered as an outlet through which various morbid tendencies are allowed to expend themselves, and the premature closure of which might bring these tendencies into injurious action elsewhere. There can be little doubt that this opinion is in some degree true. The hemorrhoidal effort depends on a general disordered condition, which, if not directed to the rectum, would find some other point upon which to expend its force. This is the case whether the piles are, or are not attended with a discharge of blood. But, when bleeding from the hemorrhoidal tumours has been frequent, long continued, and considerable, there is the additional consideration, that the system has in some measure accommodated itself to these discharges, and, in order to supply the loss, has acquired the habit of elaborating blood more rapidly, so that the danger of plethora from their arrest would be superadded to that of the merbid tendency in which the piles originated. The complaints which are most to be feared from the cure of piles are apoplexy and pulmonary hemorrhage; and, when a predisposition to these affections is known to exist, it should always be allowed to have some weight in the decision of the practical question. But, as piles themselves, when severe, sometimes materially interfere with the general health, it is necessary to weigh carefully the opposing considerations, and to strike the balance between them. Should the danger of the very serious complaints, above alluded to, seem to outweigh the inconvenience of the hemorrhoidal affection, and its direct injurious influence on the health, it will be better to confine our efforts to the alleviation of the symptoms than to attempt a radical cure; and, in cases in which the latter course is pursued, the propriety is obvious of counteracting the morbid tendencies by a proper regulation of the diet, and the use of suitable depletory or revulsive means, as bleeding, saline purgatives, and blisters or issues. In all instances, however, where the hemorrhoids are purely a local affection, they cannot be treated too promptly; and the number of cases is comparatively few, in which, though connected with some constitutional derangement, they may not be removed with safety, if care be taken to obviate the possible evil by suitable precautionary measures. So far as the treatment is directed to the removal of the causes, it may be carried into effect without the least hesitation.

In the medical treatment of piles, the first object is to remove the causes. Attention should, therefore, be paid to the condition of the system; and any existing plethora or general excitement, which may act as a predisposing cause, should be corrected by saline cathartics, and an antiphlogistic regimen. One or two doses of sulphate of magnesia, and a diet exclusively of vegetable food, will often be sufficient to relieve that hemorrhoidal effort of system, and consequent congestion of the rectum, which lead to a paroxysm of piles. In some cases, it may be proper also to take blood from the arm, but this necessity very rarely occurs.

As constipation is the most productive cause of piles, so is its removal the most important indication; and the complaint may often be effectually cured by keeping the bowels regularly open, and the feculent discharges in a soft unirritating condition. This is best done by a proper regulation of the diet, and by the use of mild laxatives. (See *Constipation*.) Among the best of these are confection of senna, and sulphur, which may be given separately or together, and may be usefully combined with bitartrate of potassa when the tumours are inflamed. The laxative may be given at bedtime so as to operate gently in the morning, or, as suggested by Burne, a short time before dinner so as to operate before bedtime, and thus allow the parts irritated by the evacuation to become quieted during the night. As a general rule, however, I prefer the former course; as the weight and pressure of the feces upon the rectum through the day, which is the result of the evening evacuation, are often more inconvenient than the mere irritation produced by the act of defecation, provided the feces be kept in a perfectly soft, almost semiliquid state by the laxatives employed. It will sometimes be preferable to administer a quick saline cathartic, in small doses, about an hour before breakfast. The laxative mineral waters, and the Cheltenham salt, may thus be advantageously given, and will generally operate very mildly a short time after breakfast.

In connexion with the use of laxatives, attention should be paid to the correction of those habits of the patient which tend to produce and maintain the disease. High seasoned food, alcoholic drinks, and strong coffee should be avoided; moderate exercise should be taken both on foot and on horseback; the patient should not sit habitually on soft cushions, nor sleep too warmly in feather beds; the use of acrid purgatives, especially those containing aloes, of warm emollient or stimulating enemata, and of the warm hip-bath, should be discouraged; and care should be taken to correct torpor or congestion of the liver, if this be one of the complications. Acrid secretions should be removed by castor oil, and acid in the bowels by magnesia. Irritations in the bowels or neighbouring pelvic viscera should be corrected if possible, and practices carefully shunned which tend to produce such irritations.

While removing the causes of piles, we may also advantageously direct our remedies immediately to the seat of disease. One of the most efficacious means of cure is the injection daily, after the bowels have been evacuated, of half a pint or more of cold water into the rectum; and, by a perseverance in this plan for several months, with laxatives if required, cures have been effected even in very unpromising cases. Care should be taken not to irritate the rectum by an unskilful introduction of the pipe. Sponging the anus with cold water every morning and evening will also be found useful.

Should the tumours be inflamed, rest in a horizontal posture, with lotions of cold water, or lead-water; and, when the pain is very severe, liniments, ointments, or cataplasms containing opium, hyoscyamus, belladonna, or stramonium, or decoctions of poppy heads or hops, should be employed. These anodyne applications are not only useful by allaying pain, but contribute to a cure by obviating the tenesmus and straining, which tend so strongly to sustain and aggravate the complaint. But caution is necessary, in their application, not to allow them too powerfully to affect the system. When the tumours are highly inflamed, and severe pains shoot to the neighbouring parts, leeches, or cups to the sacrum are useful. The application of the leeches directly to the tumour is not advisable; as the inflammation from the bite may be more injurious than the depletion is beneficial. In the proper varicose tumours, punctures with the lancet so as to evacuate the blood they contain, have been recommended; but the use of needles is preferable, as they answer the purpose of relieving the distended varices, without the risk of inflammation. When the inflammation is not acute, benefit may sometimes be obtained from astringent applications. Ointment of galls with opium may be used when the tumours are external; decoction of galls or oak bark, or infusion of catechu or kino, when they are internal. If the internal piles have protruded, and do not return of themselves, and cannot be returned by the patient, the practitioner must endeavour to reduce them by placing the patient on his hands and knees, anointing the parts well with unctuous matter, then making gentle and uniform pressure so as to force out the blood, and, lastly, introducing by his hands the diminished tumour within the sphincter. Should he not succeed by these means, he may apply cold water to the part in order to produce contraction, or let out the blood by means of needles or a lancet, and then restore the piles. In cases where strangulation and gangrene have taken place, poultices with laudanum should be applied locally, and the patient kept under the influence of opiates, with wine, quinia, and a nutritious diet, if necessary to support his strength.

When the hemorrhage is so copious as to require treatment, if it be acute, the patient should lie on his back, cold water should be injected into the rectum, and applied externally, and nitre with antimonials, or the acetate of lead given by the mouth. If these measures fail, a solution of alum or a strong vegetable astringent infusion, or the two combined, may be used in the form of enema. In more chronic cases, the same astringents may be employed, and recourse may at the same time be had to the internal use of oil of turpentine, in the dose of from fifteen to thirty drops three or four times a day, or of copaiba in the same dose, or of ergot to the amount of two scruples or a drachm daily in divided doses. The oil of turpentine has been especially praised in obstinate cases of hemorrhoidal flux. Aloes has been highly recommended, and may prove useful, in some cases of passive hemorrhage, by stimulating the rectum.

Copious mucous, or muco-purulent discharges may be treated, if acute, simply as inflammation, if chronic, by injections of acetate of lead, sulphate of zinc, or astringent infusions or decoctions.

Numerous remedies, besides those already mentioned, have obtained more or less credit in the treatment of habitual piles. *Linseed oil*, given in the dose of two fluidounces every morning and evening, is said to have very rapidly effected cures. (See *Am. Journ. of Pharm.*, xxiii. 87.) The *confection of black pepper* of the British Pharmacopœias, made in imitation of *Ward's paste*, which formerly had a very great reputation as a remedy in piles, is very highly recommended by Brodie and others. It is given in the dose of a drachm twice or three times a day, and should be continued for two, three, or four months. It probably acts by stimulating the mucous membrane of the rectum, as it passes out with the feces, and should not be given during acute inflammation of the parts. Sir Everard Home found it very efficacious, when introduced directly into the rectum. Its employment should be accompanied with the use of laxatives. Powdered *cubebs* taken internally, in the dose of a scruple or half a drachm three times a day, has proved useful, probably in the same way. *Copaiba*, in the quantity of from twenty to forty drops, once or twice a day, was recommended by Dr. Cullen. It probably acts both by its laxative and stimulant properties. Another remedy, which appears to operate in the same manner, is *black pitch*. Dr. Wardleworth found it highly efficacious in numerous cases, in the quantity of six grains given in two pills every night. (*Lond. Lancet*, Aug. 27, 1842.) Even *aloes*, the abuse of which is thought to be a common cause of hemorrhoids, will prove useful, by its irritant and laxative action, in some cases of piles dependent upon relaxation of the hemorrhoidal vessels. A tincture of aloes and anise, given in such quantities as to produce several soft stools daily, was found highly efficacious by Drs. Pindell and Crockett, of Lexington, Kentucky. (*N. Am. Med. and Surg. Journ.*, iii. 193.) Burne recommends an ointment made with a drachm of *black hellebore* and an ounce of lard, applied morning and evening to the parts affected. The pain is much increased at first, but in the course of half an hour is greatly diminished or disappears. (*Dict. de Méd.*, xv. 211.) Dr. Symonds has known great benefit to result from the assiduous use of *citrine ointment* properly diluted. (*Tweedie's Syst. of Pract. Med.*) Dr. Good states that the tumours, when not very sore, will often yield to a *layer of gypsum*, or *fuller's earth*, rubbed into a soft paste. *Bougies* are extolled by different authors; and radical cures are asserted to have been frequently obtained by their means. They are particularly useful in cases attended with rigid contraction of the sphincter ani. They should be very smooth, and of different sizes, so as to be accommodated to the different circumstances of the case. In some instances, where there is a great tendency to prolapsus of internal piles, advantage may be obtained from the support of a *spring pad*, connected behind with an elastic belt, or from a compress and bandage.

When other means fail, and the health of the patient suffers, or the inconvenience of the tumours is very great, recourse may be had to their extirpation either by the knife or ligature, or by both united. The evacuation of the tumours by incision, or by the removal of a portion of their summit by the bistoury or a pair of bent scissors, and their destruction by different caustics or the actual cautery, are modes of cure which have had their advocates. But this branch of the subject belongs properly to the surgeon. Nitric acid, applied with a view to its caustic effect, has recently been highly recommended. (See *Lond. Med. Times and Gaz.*, April, 1853, p. 343, and Aug. 1854, p. 184.)

Should the cure of piles be found to have occasioned any serious injury to the health, endeavours should be made to restore the hemorrhoidal disease by aloetic purgatives, irritating injections, and the use of the warm hip-bath.

Article IX.

FISSURES OF THE ANUS.

Ulcers in and near the anus occur from various causes, as from the abrasion or tearing of the parts during difficult defecation in hemorrhoids, stricture, obstinate constipation, &c., from violence proceeding from some external cause, from venereal infection, and from inflammation; and these ulcers are sometimes very inconvenient from their discharge, and the pain they occasion at the time of going to stool; but they generally yield without much difficulty to suitable remedies, and are a subject rather for surgical than medical treatment. But there is a particular form of ulceration, to which the name of fissure of the anus has been applied, which requires a brief notice.

The ulcer, in these cases, is situated between the folds of the skin or mucous membrane at the anus, and probably owes its exceeding severity and obstinacy to the circumstance that it is embraced by the sphincter muscles, and is therefore liable to constant injury from their movements. It runs in the direction of the rectum, is narrow and elongated, being a line or two in breadth, and from four to ten lines in length, and is generally of a lively red colour, without much swelling and induration, not unlike the crevices which sometimes occur in the lower lip of those much exposed to the cold in winter. It may occupy any part of the circumference of the anus, and is somewhat differently placed in relation to its length, being sometimes so low as scarcely to reach the mucous membrane at its upper extremity, and sometimes so high as not to reach the skin at its lower. A slight oozing of liquid takes place from its surface, and the feces, when discharged, are occasionally streaked with blood; but neither of these phenomena is constant.

At the commencement, the symptoms are not usually very severe. A sense of itching, tingling, heat, and sometimes pain, is experienced during and after a stool, which gradually increases, and at length becomes very distressing; but months or even years may pass before the complaint reaches its greatest height. In some instances, however, the painful symptoms occur at the beginning. When the disease is completely formed, there is felt, whenever the patient goes to stool, a violent burning or rending pain, which sometimes amounts to insupportable agony, giving rise even to syncope or convulsions. This continues for some time after defecation; but at length subsides, leaving only soreness, or occasional lancinating pains, which are quite tolerable. So great is the suffering of the patient during the passage of the feces, that he dreads the recurrence of the act, and is apt to postpone it as long as possible, though he thereby increases the difficulty when the time for an evacuation arrives. Most pain is experienced when the feces are hard, but is by no means entirely avoided by keeping them in the liquid state. In some cases, the suffering at length continues in the intervals of defecation, so that the patient is compelled to keep his bed; severe pains shooting from the anus to other parts of the pelvis, and the tenderness of the parts being so great that the least effort which causes pressure on the bowels, as the act of coughing or even spitting, produces great uneasiness. The introduction of the finger or an instrument into the anus occasions exquisite pain; and there is almost always great difficulty in introducing the finger, in consequence of a *spasmodic contraction of the sphincters*, which is considered by some an essential part of the complaint.

Fissure of the anus is apt to be mistaken by the patient and his attendant for piles, prolapsus, stricture, disease of the bladder or prostate, or for cancer; but a careful examination of the parts will reveal its nature. The ulcer generally becomes visible between the folds of skin at the anus by separating them; but if not, the patient should be induced to protrude the anus as in the act of defecation, so as to bring it within view. If too high up to be seen, the finger introduced into the anus will detect it by the exquisite pain produced by pressure upon a particular part, and by a different sensation communicated to the finger by that part, though any considerable induration or thickening is seldom or never present.

The disease has no tendency to spontaneous cure, and in general goes on indefinitely unless arrested by proper treatment. It has been asserted, however, that, when above or below the sphincters, the ulcers heal readily upon suitable applications, like other sores; and that peculiar obstinacy is experienced only when they are embraced by those muscles. This statement, though not perhaps sufficiently supported by facts, is highly probable; and the mode of cure found most effectual tends to confirm the view, that the contraction of the sphincters constitutes the chief source of difficulty. Unless arrested, the disease at length affects the general health, dyspepsia and emaciation occur, and the patient is worn out by complicated derangements.

Causes.—The idea has been entertained that this affection is of a peculiar character, and owes its origin to some peculiar and unknown cause. The probability, however, is, that it may arise from any cause capable of irritating or mechanically injuring the part affected; and that it is peculiar only from its situation within the limits of the sphincter muscles, which render the ulcers irritable and indisposed to heal, in consequence of incessant disturbance.

Treatment.—The measures ordinarily found useful in ulcerative affections, generally produce in fissures of the anus no other advantage than some alleviation of the symptoms. Gentle saline purgatives, with a mild laxative diet, prove beneficial partly by keeping the feces in a liquid state, and thus obviating mechanical injury in their passage, and partly by obviating any irritant effect from over-excitement. Anodyne and emollient enemata also sometimes afford relief. Boyer employed a mixture consisting of equal parts of lard, juice of houseleek, juice of black nightshade, and almond oil, injected in the quantity of a few tablespoonfuls two or three times a day into the rectum. (*Dict. de Méd.*) But this can act only as a soothing application. Dupuytren found great advantage from the extracts of belladonna and stramonium. He employed an ointment made by rubbing together a drachm of extract of belladonna, a drachm of acetate of lead, and six drachms of lard, a portion being applied several times a day, spread upon a tent, which was small at first, and gradually increased to the size of the index finger. (*Am. Cyc. of Pract. Med. and Surg.*, ii. 121.) M. Bretonneau, of Tours, has used with great success injections of extract and tincture of rhatany. His plan is to administer every day an injection of cold water, and, after this has come away, another composed of a drachm and a half of extract of rhatany, half a drachm of the tincture, and five fluidounces of water. Improvement is generally experienced at the end of a week or sooner, and a cure often accomplished in two or three weeks. (*Med. Exam.*, iii. 552.) Dr. W. P. Johnston, of Philadelphia, has employed the same remedy with success. (*Ibid.*, iv. 293.) It is probable that kino, catechu, or other astringent extracts, would answer the same purpose. M. Deday recommends tannic acid, mixed with fifteen parts of lard, to be applied by the finger to the part, or, when the fissures are situated high up, a solution of the same substance to be injected. (*Ann. de Thérap.*, A. D. 1847, p. 170.) Beclard applied nitrate of silver to the ulcers with almost uniform success; but others who have tried the remedy have been less fortunate. (*Dict. de Méd.*, iii. 300.) Dilatation by means of tents is strongly recommended by Velpeau. For this purpose, plugs of lint may be used, covered with some mild ointment, and gradually increased in size till the resistance of the sphincter is overcome. Advantage would probably accrue from combining dilatation with the application of lunar caustic to the ulcers. Boyer, by whom the disease was first clearly described and designated, was in the habit of treating it by dividing the sphincters. This practice was eminently successful, but has sometimes failed, and two instances are on record in which it proved fatal. (*Dict. de Méd.*, iii. 303.) The operation, therefore, should be resorted to only after other measures have failed. Mr. Richard Quain, Surgeon of the University Hospital, London, considers the division of the sphincter unnecessary, having found the affection to yield to a longitudinal incision of the mucous membrane through the ulcer. The tension of the membrane is thus removed, and the ulcer heals. Mr. Quain, though the operation was original with him, ascribes the priority to Mr. Copeland. (*Lond. Med. Times and Gaz.*, July, 1852, p. 83.)

Article X.

PROLAPSUS ANI.

Prolapsus ani is a descent of a portion of the rectum or its lining membrane below the sphincters, forming a tumour at the anus. In some instances, the upper portion of the rectum descends through the lower, exactly as in intussusceptio, and protrudes externally. The same thing has happened to the colon, and even the cæcum has been known to be thus everted, and to be forced through the anus. The extent of this kind of prolapsus is sometimes very great; and a case is on record in which the length of the protruded portion of bowel was two feet. But such incidents as those above mentioned are rare. The affection commonly called prolapsus ani consists of a protrusion of the lower portion of the mucous membrane only of the rectum, the outer coats being too firmly connected with the neighbouring parts to admit of eversion, under any ordinary circumstances.

Symptoms.—Occasionally a considerable protrusion takes place at once, under some peculiarly strong force applied to the part; but in general there is only a small tumour, in the form of a regular ring about the anus, appearing when the patient strains at stool, and either retroceding spontaneously, or disappearing under slight pressure when the straining ceases. If the affection be not arrested in this stage, the prolapsus recurs at each stool, and gradually increases, forming at last a considerable tumour, an inch or more in length, which is sometimes difficult of reduction, and always very inconvenient to the patient. Sometimes the protruded membrane takes on inflammation, either from the constriction of the sphincters or some other cause, and becomes so swollen and painful as to render reduction impossible, until after the inflammation has been subdued. Instances have occurred in which the protruded part has been strangulated by spasmodic stricture of the sphincters, and symptoms resembling those of hernia, with mortification of the membrane, have occurred. This result, however, is more to be apprehended in cases of eversion of the whole thickness of the bowel, than where the mucous membrane only protrudes. The prolapsus sometimes continues long unreduced without serious results; as the parts affected have a wonderful facility of accommodating themselves to their new position, and the mucous membrane takes on the characters of the skin.

Causes.—Whatever irritates the rectum, and occasions severe straining at stool, may give rise to prolapsus ani. Hence, the affection is common in dysentery. Aloetic medicines, frequent irritating enemata, ascarides, costiveness, piles, other tumours or thickening of the rectum, and complaints of the prostate, bladder, and urethra act in the same manner. Strong contraction of the abdominal muscles without tenesmus, as in the crying of infants, and in protracted parturition, may also produce prolapsus. But these causes are much more efficient, when a relaxation or atonic condition of the sphincters coexists. When these muscles are much relaxed, the prolapsus sometimes takes place under the ordinary degree of force to which the rectum is exposed in defecation. It is said to have occurred as the result of sudden fright, producing relaxation of the sphincters. In most cases, however, the straining and relaxation of the sphincters co-operate. The affection is very common in children, and more so in old age than in middle life.

Treatment.—The objects in the treatment are first to return the prolapsed bowel, if it remain without the anus, and then to adopt such measures as may prevent subsequent protrusion. The former object is in general easily accomplished; nothing more being necessary than to press regularly and gently with the oiled palm of the hand upon the tumour, or to push up the membrane with the oiled index finger inserted into the anus. If constriction of the sphincter oppose the reduction, it should be relaxed by means of the warm hip-bath, warm poultices or injections containing laudanum, and bleeding if necessary. Sometimes the sudden application of cold produces the same effect. If the protruded parts be inflamed and swollen, they should be treated with depletion, an antiphlogistic diet, cold applications, and a proper posture.

In the prevention of prolapsus three indications are offered; one, to obviate irritation of the rectum, the second, to obviate relaxation of the sphincter, and the third to produce contraction of the membrane liable to protrusion, and adhesion between it and the parts with which it is in contact. The *first* indication is met by keeping the bowels regularly open, and the feces soft, by means of a mild laxative diet and laxative medicines, by avoiding all causes of direct irritation to the rectum, and removing those which can be ascertained to exist, and by the use of anodyne enemata. Dr. Physick was in the habit of prescribing for children with this affection a diet of rye-mush and molasses, and the performance of the act of defecation in the erect position, so as to prevent much straining. To answer the *second* indication, that is, to obviate relaxation of the sphincter muscles, when it exists, cold water should be applied either by a sponge, or by directing a continued stream against the anus; astringent injections should be thrown into the rectum, or astringent ointments introduced by means of a pledget of lint within the sphincters; and, when the case is wholly unattended with irritation of the rectum, substances calculated to stimulate the sphincters may be given by the mouth, as copaiba, cubebs, or oil of turpentine. To consolidate and fix the membrane, which is the *third* indication, infusions or decoctions of the vegetable astringents, as kino, catechu, rhatany, galls, and oak bark, or solutions of the mineral astringents, especially alum, should be injected, with a little laudanum, after each protrusion. Mr. Vincent recommends strongly the injection of a solution of sulphate of iron. (See *Am. Journ. of Med. Sci.*, N. S., xv. 546.) In children, almost all cases will yield to this simple treatment, with attention to the state of the bowels as above directed. But in old cases, in which the fibres connecting the protruded membrane with the other coats are much elongated, it becomes necessary to establish new adhesions with the neighbouring structure; and this may often be accomplished by slipping off longitudinally, with a pair of scissors, small portions of the membrane, or by applying caustic carefully over small longitudinal strips of its surface. Great advantage is also said to have accrued from passing a ligature through the membrane, and allowing it to remain so as to excite inflammation and adhesion; and the plan has even been adopted by some surgeons of amputating the dependent flap. These latter methods, however, should be resorted to only in extreme cases, after the milder have failed.

Dr. S. M. Baer, of Baltimore, has invented a chair, which, by supporting the parts about the anus during evacuation, is said to prevent the prolapsus, and thus ultimately to effect a cure. (*Am. Journ. of Med. Sci.*, N. S., xxv. 552.)

When a permanent cure cannot be obtained, and the intestine is disposed to protrude even in the intervals of the evacuations, the patient may be made more comfortable by substances in the form of pessaries introduced into the rectum, or, which is perhaps preferable, by constant pressure upon the anus made by means of a spring pad, or a suitable bandage and compress. For more particular information on these various points requiring manual interference, the reader is referred to treatises upon surgery.

SUBSECTION V.

DISEASES OF THE STOMACH AND BOWELS CONJOINTLY.

There are certain diseases so equally shared by the stomach and bowels, that it is impossible to attach them specially to either section of the alimentary canal. Such are the different forms of cholera. It may be said that in dyspepsia the stomach and bowels are both diseased, and that mucous inflammation often attacks both parts conjointly, constituting gastro-enteritis. This is true; but these affections may be restricted to one portion of the canal, and generally have their primary seat in one portion; the other parts being secondarily involved. They may, therefore, be considered as especially belonging to a particular section. But this is not the case with cholera. It would not be cholera, unless both stomach and bowels were involved. It was, therefore, necessary to form this subsection; and, as it has been formed, it was most convenient to consider flatulence in connexion with it; as the pathological conditions in which this affection originates, are very apt to involve both divisions of the canal. I place peritonitis in the same category; as, when general, it necessarily involves both the stomach and bowels, and could not be with so much propriety associated with any other set of diseases.

Article I.

CHOLERA MORBUS.

The name of cholera is given to any complaint in which the prominent characters are simultaneous and repeated vomiting and purging, with painful spasm of the stomach and bowels, and occasional cramps of the external muscles. Three varieties of the disease have been observed, so different in the circumstances of their occurrence, as well as in their symptoms, progress, and results, as to merit distinct consideration. These are *cholera morbus, epidemic* *cholera*, and *cholera infantum*. The present article is devoted specially to the first of these affections. It is the variety so common as an endemic disease in various parts of the United States during the summer season, and no doubt the same as that noticed by the ancient authors, and described by Sydenham as occurring epidemically in England towards the close of summer and beginning of autumn. By recent European writers, it is distinguished from the epidemic variety by the name of *common* or *sporadic cholera*.

Symptoms.—Cholera morbus is generally characterized by the vomiting and purging of bilious matter. It often comes on suddenly, especially when the immediate result of some irritant influence on the stomach and bowels; but, not unfrequently, it is preceded for some hours or even days by a feeling of weight or other uneasiness in the epigastrium, colicky pains, more or less headache, and sometimes by furred tongue, chilliness, and a slight febrile excitement. The vomiting and purging are usually preceded by a good deal of nausea, and attended by spasmodic pain in the stomach, which is sometimes excruciating, but is relieved after each discharge. In the intervals between the paroxysms of vomiting, the patient, though comparatively easy, often experiences distressing nausea, or a burning sensation in the epigastrium, and complains of general languor and exhaustion. The discharges generally consist at first merely of the ordinary contents of the stomach and lower bowels; the matter vomited being either food recently taken, or colourless and often sour or acrid liquid, and the dejections fecal. But these are, in the vast majority of cases, soon followed by bilious matter of a green or yellow colour, and very often extremely bitter, and more or less acrid. The pulse is usually feeble, the countenance pale and shrunk, the skin cool and damp, the urine scanty or suppressed; and, in severe cases, the patient is not unfrequently affected with very painful cramps of the muscles of the abdomen and extremities, especially of the legs. These irregular muscular movements amount sometimes to general convulsions. In favourable cases, the more violent symptoms subside after a few hours, or readily give way to treatment, leaving only temporary debility. But occasionally the complaint, either from original violence or neglect, assumes an alarming character. The vomiting and purging are almost incessant; everything taken into the stomach is promptly rejected, the discharges being often brown or blackish, acid, or even bloody; the sufferings from nausea, anxiety, heartburn, and spasmodic pains, both internal and external, are intense; the patient complains of extreme thirst, and is clamorous for cold drinks; the pulse is small, frequent, irregular, and extremely feeble, the respiration short and frequent, the extremities cold, the eyes sunken and surrounded with a dark areola, the skin bathed in cold sweat; hiccough and abdominal distension come on, with a cessation of the vomiting; and the patient, if not rescued by remedial measures, sinks in a state of complete exhaustion, retaining his mental faculties not unfrequently to the last. Death may occur within twenty-four hours, though more frequently the complaint runs on for two or three days, before terminating fatally.

In some instances, moderate febrile symptoms attend the disorder, as if an attempt had been made to establish bilious fever, which had been prevented from entire success by the occurrence of the cholera; and, in ordinary cases, a sudden suppression of the discharges by opium sometimes gives rise to a similar state of system. Instead of being bilious, the evacuations are, in some very rare instances, colourless or whitish, somewhat as in epidemic cholera. In such cases, the attendant symptoms are of an aggravated character, though by no means necessarily fatal.

Cholera morbus generally subsides under remedies without unpleasant consequences, leaving only a moderate debility, from which the patient speedily rises by the aid of a suitable regimen. Sometimes, however, the debility is considerable and protracted, and requires medical interference. Occasionally the patient is left with a troublesome diarrhœa, or with other evidences of a continued irritation of the stomach and bowels. In intemperate persons, the checking of the cholera is apt to induce delirium tremens.

In persons of good constitution, the disease is very rarely fatal. It is most apt to prove so in the very old, the feeble, and the intemperate.

Causes.—Hot weather, long continued, strongly predisposes the system to cholera morbus, and may of itself occasion the disease without any other cause. The same may probably be said of marsh miasmata; for cholera morbus very often precedes the breaking out of miasmatic fevers, as if resulting from the operation of the same cause in a less degree. Most commonly, however, the immediate attack is brought on by some exciting cause, capable, either directly or through the nervous centres, of irritating the stomach and bowels. Among such causes may be mentioned, exposure to cold when the body is heated and perspiring; the use of certain indigestible and irritating articles of food or drink, as cabbage, cucumbers, melons, various unripe fruits, fat pork, lobsters, crabs, sour and incompletely fermented liquors, putrid water, &c.; excesses at the table, independently of the character of the food; the use of ice, or very cold drinks in excess; strong mental emotions, as fear or anger; and various movements which produce sickness of stomach through their action on the brain, as riding backward, turning rapidly in a circle, and sailing upon a rough sea. The disease prevails especially in hot countries, and during the hot season in temperate latitudes. Sometimes it is so prevalent as to put on the appearance of an epidemic, though probably dependent on the heat of the weather, or the local miasmata, in the same manner as our endemic remittent fever. In this country, it is most common in the months of July and August. It chiefly attacks adults.

Nature.—This must be inferred from the symptoms and causes; as dissection reveals nothing which can lead to any accurate conclusion. Sometimes redness or other evidence of inflammation is discovered in the stomach, or some portion of the bowels; but often no such phenomena are presented, and neither the alimentary mucous membrane, nor any other structure exhibits appearances which could explain the symptoms. The probability is, that the disease consists essentially in congestion of the portal system, produced by the continued action of a high temperature, by miasmata, or both, and inducing an irritation both in the liver and lining membrane of the stomach and bowels, which exhibits itself in an increased and altered secretion. Should the congestion from these causes be alone inadequate to the result, a superadded irritation, from the various exciting causes above enumerated, may be required for the production of the phenomena of the disease. The painful gastric and intestinal symptoms may result either from the general state of sanguineous congestion in the whole canal, or from the irritating quality of the morbid bile and intestinal secretions, or from both. That the liquids referred to are the source of much of the pain and spasm, is evident from the temporary relief which follows their discharge. The prostration is owing partly to the profuse evacuations, partly to the depressing influence of the nausea. The extreme thirst, instead of being an evidence of inflammation of the stomach, is the mere expression, in the throat and neighbouring parts, of the wants of the blood-vessels, deprived of a large portion of their more fluid contents. The spasms of the extremities are probably one of the consequences of the gastric and intestinal irritations, acting through the nervous centres.

Diagnosis.—Vomiting and purging, with more or less bile in the evacuations, are not unfrequent attendants upon other diseases, as bilious fever, gastro-enteritis, and inflammation of the liver. From the first of these, however, cholera morbus may be distinguished by the absence of a hot skin, a strong pulse, and headache, and by its much shorter course; from the two latter by the same absence of decided febrile symptoms, and the less degree of tenderness. There may be greater difficulty in distinguishing it from the effects of certain mineral poisons. I have seen the operation of calomel in some instances so exactly like cholera morbus, that the most experienced eye could scarcely have detected the difference. But, in poisoning by corrosive substances, the vomiting generally precedes the purging by a considerable interval, the discharges are seldom so highly bilious, and the poison may often be detected in the evacuations. The circumstances attending the origin of the complaint, and the season of the year, may also be taken into consideration in forming the diagnosis. Bilious diarrhœa is sometimes attended with moderate vomiting; but this affection may be considered as only an inferior grade of cholera. The vomiting and purging produced by indigestible food, in a system not predisposed to cholera morbus, are scarcely entitled to rank with that disease.

Treatment.—The following mode of treatment will very generally be found promptly effectual, in ordinary cases of cholera morbus. It is founded on the indications, 1. of removing the irritating causes by clearing out the stomach, 2. of checking the irritation directly by the moderate action of opium, and indirectly by powerful revulsion to the surface, and 3. of changing the morbid action of the liver by the alterative influence of calomel. Mild diluent drinks are to be administered freely; a sinapism of pure mustard mixed with water, to be applied over the epigastrium; and a pill containing the sixth of a grain of calomel and from the sixth to the twelfth of a grain of opium, to be given every half hour, or every hour, according to the urgency of the symptoms. The drinks should consist of chicken tea made by boiling, for a very short time, a portion of chicken, deprived of skin, in a large quantity of water so as merely to impart a slight taste to the liquid; of mucilaginous or farinaceous fluids, such as solution of gum arabic, mucilage of sassafras pith or flaxseed, toast-water, barley-water, &c.; of mild herbaceous infusions, as balm or mint tea; or, finally, of lukewarm water. They should be given freely at first, so as to facilitate the evacuation of the acrid bile, and then suspended, or administered moderately merely to relieve the thirst of the patient. For this purpose, also, as well as to quiet irritation of stomach, carbonic acid water, in small draughts of about two fluidounces, frequently repeated, answers admirably well. The mustard cataplasm should be left on for half or three-quarters of an hour, or until it reddens the skin intensely, and becomes no longer tolerable. In severe cases, or in the advanced stages, when the prostration is great, it is often necessary to administer opium more freely than above directed. From half a grain to a grain of opium in pill, or, what is generally preferable, from twelve to twenty-five drops of laudanum, or an equivalent quantity of the solution of sulphate of morphia, may be given, and repeated at longer or shorter intervals until the violence of the symptoms abates. But the least quantity of opium that will answer the purpose is the best; as, though it is necessary to allay the pain, and check the discharge, yet a complete and sudden suspension of the secretion is not desirable. There is danger, if the congestion be not allowed to relieve itself, that fever or inflammation may ensue. Hence one of the advantages of uniting calomel with the opium. Large doses of the mercurial are not required; as experience has shown that, in the minute doses before mentioned, frequently repeated, it acts effectually on the liver, while it is less liable to irritate the stomach and bowels.

If the disease should resist the above measures, recourse may be had to a blister over the epigastrium, and powdered acetate of morphia may be sprinkled on the blistered surface deprived of its cuticle. Injections of laudanum, with thin starch or mucilage, may also be given. In cases of great prostration, rubefacients may be applied externally, and blisters to the insides of the arms or legs; and tincture of camphor, aromatic spirit of ammonia, wine-whey, and even ether, may be given internally, in conjunction with the opiate.

Should diarrhœa continue after the vomiting has ceased, it should be treated as directed under the head of that disease. Should fever follow a suspension of the discharges, the bowels should be kept open by small doses of some mild cathartic, as the Seidlitz powder, or a solution of carbonate of magnesia in carbonic acid water, commonly called liquid magnesia; and the effervescing draught and cooling drinks should be administered at short intervals. Symptoms of gastric inflammation may be counteracted by leeches to the epigastrium, followed by warm fomentations or emollient cataplasms. Intestinal irritation may be treated by emollient enemata, and mild laxatives, as castor oil with a little laudanum.

Various other modes of treating cholera morbus have been recommended. Some practitioners, considering it essentially gastritis or gastro-enteritis, have relied chiefly upon bleeding, leeching, and demulcents. But this is hazardous practice. Ipecacuanha, in emetic doses, has had its advocates. Nitric acid has been lauded as a specific. Hope's mixture, consisting of a drachm of nitrous acid, forty drops of laudanum, and eight fluidounces of camphor water, and taken in doses of two fluidounces every three or four hours, has in its favour the recommendation of Dr. C. D. Meigs, of Philadelphia, as well as that of its original proposer. (*N. Am. Med. and Surg. Journ.*, ii. 419.) Dr. D. J. Cain has found great advantage from the use of creasote. (*Charleston Med. Journ. and Rev.*, vii. 145.)

During convalescence, the greatest caution should be observed in relation to the diet, which should consist of mild and easily digested aliment, such as farinaceous substances, milk, cream, broths without fat, and the lighter forms of solid animal food.

Article II.

EPIDEMIC CHOLERA.

Syn.—Spasmodic Cholera.—India Cholera.—Asiatic Cholera.—Malignant Cholera.—Cholera Asphyxia.

This disease appears to have been long known in India; but it first began to attract the attention of the medical profession generally in the year 1817, when it broke out as an epidemic with great violence in Bengal, and from that province, as a centre, commenced the fearful march, which did not cease until it had encircled the globe. In its progress westward, it ascended the Ganges, pervaded Central India, and, crossing the mountainous range of the Ghauts, established itself, in the year 1818, upon the western coast of the peninsula. During the same year, it made its way southward to Madras; in 1819, crossed the sea to Ceylon; and, before the close of the latter year, appeared in the Mauritius and the Isle of Bourbon. At the same time, it was slowly advancing towards the east and southeast; invaded the Burman dominions; attacked Siam, the peninsula of Malacca, and the island of Sumatra; and, in 1820, had reached Canton and the Philippine Islands. It was subsequently heard of as extending its ravages into the northern parts of China, and into Tartary. After arriving at the western coast of the peninsula of Hindostan, it paused for a while before leaving its native soil; and it was not till the year 1821, that it appeared on the shores of the Persian Gulf. From this position it ascended the Tigris and Euphrates; in 1822, passed over the desert into Syria; and, in 1823, having made its way northward through Persia, reached the shores of the Caspian Sea, and seized upon the Russian city of Astracan. It had now traversed the whole length of Asia, and was pressing upon the confines of Africa and Europe. Here it again paused; and several years elapsed before it crossed the boundaries, and commenced a new career of invasion in these hitherto undisturbed regions. In 1828, it appeared at Ohrenburgh, on the borders of European Russia; but it did not fairly enter Europe until 1830, when it advanced as far as Moscow. In 1831, it took a westward course, attacked St. Petersburg, Warsaw, Dantzic, Berlin, and Hamburg, and showed itself in Sunderland, on the northeastern coast of England. In 1832, it reached Paris and London; and in the same year, overleaping the barrier of the Atlantic, appeared in Quebec on the 8th of June, and at Montreal on the 10th; and thence pursued a rapid course, along the St. Lawrence and the Lakes, to the valley of the Mississippi River. A detachment from the main line of invasion, as it crossed the Atlantic, appears to have struck the shores of the United States at New York, where the disease broke out on the 24th of June. Thence it spread northwardly up the Hudson, and southwardly to the Delaware and Chesapeake Bay, reaching Albany on the 3d or 4th, and Philadelphia on the 5th of July, and Baltimore in the course of the same month. About the beginning of November, it appeared in an island off Charleston; in February, 1833, at Havana, in Cuba, where it committed great ravages; and, before the end of that year, in Mexico. At the same time that the epidemic, leaving the northwestern borders of Asia, was spreading consternation throughout the north of Europe, it took also a southward course from Syria, penetrated the deserts of Arabia, and invaded Egypt, appearing in Mecca, in May, and in Alexandria, in August, 1831. It was very late in attaining the extreme north, and the extreme south of Europe. Thus, Sweden was not visited until one or two years, nor Sicily until four years after the epidemic had reached New Orleans. In this country, there were partial returns of the disease subsequently to its original appearance, and it prevailed to a considerable extent in the year 1834; but both in North America, and the greater part of Europe, it disappeared entirely in somewhat more than two years from its first visitation.

In India, however, the disease continued as an endemic, and, at the date of the first publication of this work, in the early part of 1847, we had received accounts of its having commenced a new march of desolation in the East. Before the close of that year it again entered Europe, and afterwards advanced regularly westward, pursuing a course singularly corresponding with that of its first invasion, both as to the succession of regions visited, and the period of its approach and departure. Setting out from India as before, it passed destructively through the cities of Persia, skirted the shores of the Caspian, and reached Astracan in July 1847, and Moscow before the close of the year. Here its progress was suspended during the winter; but in the spring of 1848 it again advanced westward, in June arrived at St. Petersburg, in August at Berlin, in September at Hamburg, and crossing thence to Great Britain, attacked Edinburgh in October, and London soon afterwards. On the ninth of November, a ship with emigrants sailed from Havre for New York. At the time of her departure there was no cholera either in that port or at Paris, and the crew and passengers were all healthy. The vessel had been sixteen days at sea when the disease appeared on board, and she arrived with it at the quarantine ground at Staten Island, on the first of December. The passengers were landed, and very soon afterwards the disease broke out in the neighbourhood. It did not, however, extend beyond the quarantine enclosure, and ceased entirely about the beginning of the new year. Three deaths occurred from it in the city of New York. Another ship, which had left Havre on the second or third of November, without cholera on board, was attacked with the disease twenty-six days after leaving port, and brought it with her to New Orleans, where she arrived on the eleventh of December. Cases of cholera soon afterwards occurred in the city, and rapidly multiplied, the weather being at the time very hot, and of course favourable to the spread of the disease. From New Orleans it extended to Texas, and up the Mississippi, reaching the city of Memphis so early as the twenty-second of December, and sweeping over the valley of that great stream with unheard of rapidity. It did not, however, surmount the Alleghanies; and, with the exception of the slight demonstration made in the harbour of New York, the Atlantic States remained free from the disease during the winter. The epidemic cause, however, was in the mean time pursuing its regular course across the Atlantic; and, as on the previous occasion, reached our shores in the season following that of its appearance in western Europe, though somewhat earlier than in the year 1832. It broke out in New York about the beginning, and in Philadelphia about the close of May, 1849; and while, commencing at the Atlantic coast, it visited many parts of our country on this side of the mountains, it seemed to take a fresh start from New Orleans, and again spread along the tributaries of the Mississippi with fearful violence. In its further progress, it invaded the West Indies and Mexico, and, crossing the whole breadth of the continent, reached the shores of the Pacific, producing as it went great havoc among the emigrants on their way, like itself, to California. It attacked the cities of St. Fransisco and Sacramento in October, 1850. In the summer of 1850, and in every year since that time, it has occurred to a greater or less extent in various parts of the valley of the Mississippi, in which there is reason to fear that it has become naturalized; but the section of our country, east of the Alleghanies, with some slight exceptions, remained exempt, from the period of its visitation in 1849, until the summer of the present year (1854), when it again made its appearance in the epidemic form, having pursued the same course as on former occasions, from the Eastern parts of Europe, through the north of that continent, to Great Britain, and thence across the Atlantic to the United States.

From the above brief account of the progress of cholera, it will be seen that its march is extremely irregular, in relation both to time and direction. Sometimes it advances with great rapidity, sometimes slowly, and sometimes pauses for a longer or shorter period, giving hopes to the yet unvisited countries, that they may escape its ravages. In general, its progress is arrested during the winter, to be resumed in the spring; though this is not invariably the case; for at Moscow it prevailed through most of the winter of 1830–31; and the cold weather did not prevent its spreading along the Mississippi in the winter of 1848–49. Though preferably following the course of streams, affecting low and damp places, and attacking the filthy and crowded portions of populous cities, it is yet absolutely confined to no particular character of locality, but shows itself occasionally upon lofty mountains, in the midst of sandy deserts, and among the scattered inhabitants of thinly peopled agricultural districts. No barriers are sufficient to obstruct its progress. It crosses mountains, deserts, and oceans. Opposing winds do not check it. All classes of persons, male and female, young and old, the robust and the feeble, are exposed to its assault; and even those whom it has once visited are not always subsequently exempt; yet, as a general rule, it selects its victims preferably from among those already pressed down by the various miseries of life, and leaves the rich and prosperous to their sunshine and their fears. It is exceedingly capricious in the choice of its localities, not unfrequently leaving towns and districts in its line of march untouched, and deviating apparently from its course to seize upon others, in no important respect differently circumstanced. The period of its duration, in any one spot, is generally from one to two or three months; though this is much influenced by the season, being shorter for the most part when winter is near. When it prevails in the same place more than once, it usually affects fewer persons, and is of a milder character in the second attack than in the first.

Course, Symptoms, &c.—The first approach of the epidemic influence, in places about to become the seat of cholera, is usually felt in the more or less general prevalence of moderate disorders of the stomach and bowels, which precede for a short time the appearance of the disease, and continue in various degrees to affect a large portion of the population, after it has become established. Sometimes there is only a slight derangement of digestion, or a simple diarrhœa, or mild dysentery; but very frequently, the premonitory affection takes on a more decided character, and, without amounting absolutely to cholera, approaches it more or less nearly. From this circumstance it has received the name of *cholerine*, adopted from the French writers.

Cholerine, in fact, often constitutes the first stage of cholera, and in other cases is undoubtedly produced by the same cause, operating either more mildly, or upon less susceptible subjects. It is marked by a furred tongue, irregular appetite, thirst, impaired digestion, uneasiness in the stomach and bowels with a feeling of weight or distension, colicky pains, hiccough, diarrhœa sometimes disappearing and again recurring, nausea, sometimes vomiting, a feeling of general weakness and languor, a disposition to perspire, occasional neuralgic pains, and cramps in the extremities. In some instances, it is attended with febrile symptoms. The alvine discharges are sometimes bilious, sometimes of a dirty-white colour and turbid, very much resembling oatmeal gruel. Occasionally the force of the cause seems to expend itself upon the nervous system, and the patient is affected with severe neuralgic pains, and distressing spasms, amounting sometimes to convulsions, with little or no evacuation from the stomach or bowels. The affection often subsides spontaneously, or yields readily to proper treatment; but it is very apt, upon exposure to any exciting cause, and even, if neglected, without such cause, to be aggravated into cholera.

When the epidemic influence has attained an intensity adequate to the production of the full-formed disease, a few cases are first observed, usually among the lowest orders of the community. These are soon followed by others; and the numbers gradually increase until the pestilence reaches its acme; when it speedily subsides, and ultimately disappears, leaving behind it, for a short time, that same tendency to bowel complaints which had heralded its approach.

The attack often occurs after some imprudence in diet or exposure; but often also without any obvious exciting cause; and, according to some writers, most frequently in the night. It occasionally comes on with loss of appetite, pain in the back and abdomen, vertigo, noise in the ears, disordered vision, feebleness of the pulse, paleness of the face, copious sweats, a feeling of general weakness, and sometimes rigors. In the midst of these or similar symptoms, in most cases after a longer or shorter duration of diarrhœa or cholerine, but sometimes without any premonition whatever, the patient is seized with vomiting and purging, which are frequently repeated, and attended with severe pain in the abdomen, neuralgic pains in different parts of the body, and cramps of the voluntary muscles, especially those of the lower extremities. The first evacuations, in cases not originating in diarrhœa or cholerine, consist of the ordinary contents of the stomach and bowels; but the dejections which follow are of a whitish colour, thin, and watery, resembling rennet whey, thin gruel, or rice water, and, when allowed to stand, separate into a colourless fluid, and a white, flocculent, insoluble matter, which subsides. In mild cases, or after the subsidence of the severer symptoms, they are sometimes tinged with bile, and a little blood is occasionally discharged. In some instances they are brown, or of a deep chocolate colour. The matter vomited is generally similar to the stools, but is sometimes white and glairy, as if consisting of mucus, and has an acid reaction. The evacuations are usually forcibly ejected, but without apparent straining, or much voluntary effort, and are often very copious.

The cramps usually begin in the extremities, affecting especially the calves of the legs, but subsequently extend to the muscles of the trunk and abdomen. They are excruciatingly painful, and almost incessant, the muscles gathering into hard board-like knots, one contracting as another relaxes, and often distorting the fingers and toes in various directions, according to the particular muscle or muscles affected.

At the same time the pulse sinks rapidly; the extremities become cold; the features shrink; the patient is restless, and complains of intense thirst; the whole surface is bathed with sweat; the urine is scanty; and the skin begins to assume a bluish, leaden, or violet colour, which extends more or less over the body, but is peculiarly striking in the face, hands, and feet. If the complaint is not arrested, the evacuations become still more copious and watery; the thirst insatiable, with a burning heat at the epigastrium; the pulse frequent, feeble, and sometimes scarcely perceptible; the breath cool; the tongue cool and pale, though still moist; the skin unusually cold, shrunken, and inelastic, so that when pinched into folds it does not resume its former state; the hands and feet shrivelled and wrinkled, as if long soaked in water, and of a dark-purplish, or livid colour, especially at the nails, which are sometimes almost black; the eyes, deeply sunk in their sockets, and surrounded with a livid circle; the conjunctiva dry, and of a dirty whiteness; the nose and lips blue; the secretion of urine and tears suppressed; the respiration short, hurried, and oppressed; and every symptom indicative of extreme prostration. The patient is often exceedingly restless, and calls incessantly for cold water or ice, and for fresh air. With all these changes, the external sensibility often remains acute, so that mustard plasters and other irritants produce severe pain; and, though cold to the touch, the patient frequently complains of a distressing heat over the whole surface. The intellect is generally sound, but more or less obtuse; and, in all his moral relations, the patient evinces an extraordinary apathy, being insensible alike to his own danger and prospects, and to the feelings of those connected with him.

The case is now on the borders of complete *collapse.* But a step further, and the pulse becomes quite imperceptible; a feeble oscillatory movement only of the heart is discoverable upon auscultation; the blood stagnates in the capillaries; a wound of the surface yields no blood, and little or none follows the opening of a vein; the features and whole body are so shrunken that the patient can scarcely be recognized by his friends; the bluish or purplish colour often pervades the whole surface; the voice is feeble, or quite extinct; the breath almost as cold as the external air; the respiration either hurried and feeble, or very slow and scarcely perceptible; the countenance calm or quite inexpressive; and the whole aspect of the patient that of utter helplessness. The reduction of temperature is such that the thermometer, with its bulb placed under the tongue, sinks often to 90°, and sometimes as low as 80°, or even 77° F. The body has the appearance of death except the eyes, which sometimes retain an expression of intelligence, and seem as if they were looking out of a corpse. But even these are often half closed, glazed, and inanimate. In some instances, considerable muscular strength remains, and the patient suddenly rises up from bed with an expiring effort, and falls lifeless. There is a total suspension of the urinary secretion. The evacuations sometimes continue till the close, and are at last involuntary. Sometimes, however, they cease entirely for a considerable time before death. The same difference is observable in relation to the cramps, which, in some cases, do not end even with life, the muscles remaining stiff and contracted in the dead body. Intelligence is sometimes retained till within a few moments of the close. In other cases, a period of stupor precedes death. The fatal issue sometimes occurs in four or five hours from the commencement of the attack, though more frequently life is protracted for one, two, or three days. The mean duration of fatal cases, according to the report of the Registrar-general of England for the year 1848-9, was about 49 or 50 hours.

The complaint is susceptible of a favourable change, either spontaneously or under treatment, at any stage, even in that of collapse. If it is arrested early, the patient sometimes enters into a speedy convalescence, without any subsequent embarrassing symptoms, though not unfrequently diarrhœa and other evidences of gastro-intestinal irritation continue for a longer or shorter period. But, if collapse has begun before the turn of the disorder, the patient has still great dangers to encounter, and the progress of recovery, when it takes place, is often very tedious, and liable to frequent interruptions. One of the most favourable symptoms, in any stage of cholera, is the appearance of bile in the evacuations. In the cases of collapse, after the system has begun to react, a gradual restoration of the suspended functions is observed; the pulse returns, the skin becomes warm, the pallor or blueness of face yields to a red flush, the secretion of urine and bile recommences, the vomiting diminishes; but the oscillation extends frequently into a febrile excitement; severe headache is experienced; the abdominal pains, thirst, loathing of food, and diarrhœa continue; and convalescence, even in favourable cases, does not set fairly in until after several days of doubt and discomfort.

Sometimes a relapse follows the temporary excitement, and the patient sinks with all his former symptoms. Much more frequently, the febrile state continues, generally assuming a low form, with most of the characters of idiopathic nervous or typhoid fever, and unequivocal evidences of gastric or intestinal inflammation, and either ending in death, or in a very slow recovery. In some cases, the fever assumes the remittent type, and ultimately becomes intermittent. Eruptive affections, resembling those of scarlatina, rubeola, erythema, &c., occasionally diversify the stage of reaction. They are sometimes accompanied with wheals, like those of urticaria, but without the itching. Pneumonia, bronchitis, and pleurisy also not unfrequently occur, but so masked by the low state of the system, and the gastro-intestinal irritation, as often to escape the notice of the practitioner, unless upon his guard. But the most dangerous affection, in this stage of cholera, is perhaps that of the brain, characterized by headache, drowsiness, low delirium, stupor, coma, subsultus tendinum, and sometimes convulsions or paralysis. In its severe forms, it is almost always fatal. The convalescence from these secondary disorders is often protracted for months, and sometimes even for a year or more.

The course of the symptoms in cholera is not always uniform, nor exactly as above described. Sometimes the spasms are comparatively trifling or altogether absent; sometimes they constitute the chief feature of the case, to the exclusion of the ordinary evacuations. In occasional instances, the complaint is ushered in by universal and violent convulsions. Cases have been frequently observed, in which fatal collapse supervened without vomiting; and others are on record, in which there was neither vomiting nor diarrhœa, though, in such instances, the bowels, upon examination after death, were found loaded with the same whitish liquid of which the discharges consisted. In some rare instances, vomiting occurs with little or no diarrhœa. Though in general there is an interval of some hours, and sometimes of a day or more between the attack and the occurrence of collapse, so as to allow time for the intervention of efficacious treatment, yet instances are not unfrequent, in which the patient passes almost immediately into that state, and dies apparently under the first blow. The bluish aspect of the surface, so characteristic of cholera, is not present in all cases, not even in all those which end fatally. Instead of the sinking pulse, so common even in the onset of the disease, the circulation is sometimes little affected for a considerable time; and, in some cases, febrile symptoms, with a strong and excited pulse, appear in the first stage. The intellect, usually correct, though obtuse, is in some cases clouded almost from the commencement; and instances have occurred in which determination of blood to the head, and drowsiness, stupor, and numbness of the extremities were the prominent symptoms.

From an examination of the symptoms above detailed, it will be perceived that a fully developed case of cholera, running through a regular course, often exhibits four distinct stages, the observance of which is important in a practical point of view. The *first* is the forming stage, consisting of a simple diarrhœa, or of more or less of those derangements described under the head of cholerine. The *second* is that in which the symptoms of cholera are decided, but the system has not yet sunk into complete prostration, and the circulation is distinctly observable, both in the larger vessels and capillaries. The *third* is the stage of collapse, already sufficiently described. The *fourth* is that of reaction, in which the characteristic symptoms of cholera have given way to local inflammations or irritations, and to general fever. All these stages do not by any means occur in all cases. The disease is often arrested in the first or second, or proves fatal in the third, without ever reaching the fourth; and sometimes the second or even third stage comes on, without the known existence of those ordinarily preceding it.

The Evacuations.—It has been stated that the peculiar choleric evacuations, whether from the stomach or bowels, consist of a colourless liquid, holding in suspension a white flocculent matter, which subsides on standing. This insoluble matter, formerly supposed to be coagulated albumen or fibrin, was found by Dr. Boehm, of Berlin, to consist mainly of epithelial cells, in their various stages of developement, separated or adhering together; and his statements have been confirmed by subsequent microscopic observers. The clear liquid is water holding a very small proportion of saline and organic substances in solution. Of the salts, chloride of sodium is by far the most abundant. There is also in the dejections, according to Dr. Guterbock, a little carbonate of soda, with salts of lime and magnesia, but none of potassa. A little albumen may usually be detected by the agency of heat and nitric acid; but the quantity is insignificant. According to Mialhe, there is a considerable proportion of a principle which he calls albuminose, analogous to albumen, but differing from it in being uncoagulable by heat or the acids, while it is precipitated by alcohol, corrosive sublimate, tannic acid, &c. (See *Am. Journ. of Med. Sci.*, N. S., xviii. 257.) The stools of cholera are said always to have an alkaline reaction. The evacuations from the stomach differ from them mainly in being slightly acid, and in containing a smaller proportion of solid matters. Guterbock states that the former contain somewhat over 98 per cent. of water, the latter 99 per cent. (*Ibid.*, xxi. 198.)

The *urine* appears, from the observations of Dr. J. W. Begbie, to be of diminished density, and to contain in general albumen and bilious colouring matter, with the ordinary salts, but little or no urea. When examined with the microscope, it uniformly exhibits the presence of epithelium, of different forms, from all parts of the urinary passages, and even from the tubuli uriniferi of the kidneys. It presents these characters when it begins to reappear, after its almost total suppression in the prostrate state. If the case go on favourably, its normal condition returns in a day or two. (*Ed. Month. Journ. of Med. Sci.*, Nov. 1849, p. 1207.)

The *air expired* in the state of collapse contains much less carbonic acid than in health. This in some degree explains the great coldness so characteristic of the collapse of cholera.

The Blood.—The character of the blood varies with the stage of the disease. At an early period, nothing abnormal has been observed; in the stage of reaction, it often contains an excess of fibrin, consequent on the developement of inflammation. It is during the collapse, or in the state approaching it, that its composition has been most carefully investigated. In relation to this composition very discrepant statements have been made. The results here given are those obtained by the most accurate observers, among whom may be particularly mentioned, M. Becquerel, and Drs. R. D. Thompson, Gairdner, Garrod, and Wm. Robertson. According to the last-mentioned reporter, the blood was found in the early stage to be defective in red corpuscles and somewhat lighter than in health, though the proportion of albumen was somewhat above the healthy medium. This fact would tend to show that anemic persons are most liable to be attacked. (*Ed. Month. Journ. of Med. Sci.*, Sept. 1853, p. 247.) The blood in the collapse of cholera, whether from the veins or arteries, is darker, more viscid, denser, and less coagulable than in health. It does, however, usually coagulate upon standing, and separates into serum and crassamentum; but the latter has little firmness, and the former is in smaller proportion, considerably heavier, and much more deeply coloured than ordinary. As might be inferred from the character of the alvine evacuations already referred to, the quantity of water in the blood is much diminished, while that of the solids is of course proportionably increased. The *red corpuscles* are increased in larger proportion than the other constituents. From 140 parts in 1000, its highest normal proportion, it rises, according to Dr. Garrod, to 166 or 171. The proportion of *fibrin* cannot be accurately ascertained in consequence of its altered character, and imperfect coagulability. The *albumen* is augmented in relation to the water of the serum, as might be inferred from the fact, that the watery evacuations contain but very little of this principle. The *salts*, contrary to what was formerly believed, are also increased relatively to the whole bulk of the blood; but the soluble are less so than the insoluble, as must necessarily happen from the amount excreted with the gastric and intestinal discharges. *Urea* was found in the blood by Dr. O'Shaughnessy; but, from the experiments of Dr. Garrod, it appears to be in much smaller proportion in the collapse than early in the stage of reaction. At the time that the secretion of urine is suspended, and the urea of course ceases to be thrown off, it ceases also to be produced, in consequence of the failure of the organic processes which generate it in health; but, when reaction takes place, its production recommences before the kidneys are able fully to resume their function, and it now consequently accumulates in the blood. Hence, possibly, in some degree, the coma often presented at this period of the disease, and the general tendency to inflammations. Becquerel found a very greatly increased proportion of the *extractive* and *fatty matters*. (*Arch. Gén.*, 4e sér., Dec., xxi. 199.) The blood, which in the healthy state has an alkaline reaction, is said to be sometimes acid in cholera.

An indisposition has been noticed in the black blood of cholera to become reddened on exposure to the air. This has been ascribed to a deficiency of the saline constituents of the blood, which, according to Dr. Stevens, are necessary to its conversion from venous to arterial; but some doubt is thrown upon this explanation, as also upon the correctness of the therapeutical deduction that saline substances should be used in the treatment of the disease, by the ascertained fact, that the proportion of salts in the blood is increased instead of being diminished.

Anatomical Characters.—After respiration and the action of the heart have ceased, spasmodic movements of the muscles are still sometimes observable; and it is a remarkable fact, asserted by many observers, that when death occurs suddenly in the cold stage, the temperature of the body not unfrequently rises after all signs of life have ceased, and the warmth continues until cadaveric rigidity begins. The appearances upon dissection vary, according as death has taken place in the stage of collapse, or in that of reaction. When it is very speedy, it is said that sometimes no morbid changes whatever are observable. The following phenomena are ordinarily presented after death in the collapse.

The whole arterial system is emptied of blood, with the exception of a few clots in the aorta and left side of the heart. The venous system, on the contrary, is distended, especially the large veins and right side of the heart, which is gorged with a black, viscid, imperfectly coagulated blood. Almost all parts of the body, the brain and spinal marrow, the substance of the heart, the abdominal viscera, the limbs, even the spongy substance of the bones, exhibit signs of venous injection; and large ecchymoses are frequently found in all the parenchymatous glands. The vessels of the lungs, however, generally contain little blood; and the spleen is sometimes remarkably small and dry. When the abdomen is opened, the peritoneum is observed to be dry, as in fact are the serous membranes generally; and the small intestines have a rose or violet colour, owing to the venous injection of the inner coat. Sometimes, however, the serous surface of the bowel is covered with a very delicate layer of viscid matter, rendering it somewhat adhesive; and the same condition is occasionally noticed in the pleura, and more rarely in the pericardium. The mucous membrane, throughout nearly its whole extent, is usually more or less reddened, and the parietes of the bowels are somewhat thickened, in consequence of this venous injection. Patches of ecchymosis are also frequent in their coats. Enlargement of the intestinal follicles, and elevation of the elliptical patches are very commonly met with; but in some cases the mucous membrane is throughout of the natural colour, and there is no abnormal developement of the mucous glands. In many cases, an eruption of minute semi-transparent vesicles has been noticed, disappearing upon puncture, very closely arranged, and extending from the duodenum to the ileo-cæcal valve, and even into the colon. These have been considered as morbidly developed follicles; but, according to Dr. Horner, they are altogether distinct from that structure, and are formed by a mere elevation by a serous fluid of the epithelium of the mucous membrane. (*Am. Journ. of Med. Sci.*, xvi. 289.) The intestinal mucous membrane is frequently coated, to a greater or less extent, with a layer of a whitish or grayish matter, apparently identical with the flocculent substance deposited by the evacuations when allowed to stand. A similar coating is sometimes found in the stomach. The whole alimentary canal is distended with the same whitish liquid of which the evacuations consist, often mixed with a dark-reddish or chocolate-coloured liquid, which probably owes its colour to effused blood. A glairy mucus sometimes exists in the stomach, more or less adherent to the mucous coat. The texture of the membrane is seldom materially altered in this stage. The brain, spinal marrow, and nervous ganglia are little changed. The lungs are healthy in appearance, except that they are sometimes edematous, and contain a frothy liquid in the bronchial tubes; and the parenchyma of the liver and kidneys exhibits no other irregularity than an occasional venous engorgement. The gall-bladder is usually filled with a viscid, not unhealthy bile. The bladder is often very much contracted, and contains little or no urine. The mucous membrane of the pelvis of the kidneys, ureters, and bladder often exhibits the same consistent coating that was found in the bowels.

Microscopic investigations have thrown much light on the pathology of cholera. It has been already stated that the white flocculent deposit in the evacuations from the stomach and bowels, has been ascertained to consist mainly of the disintegrated epithelium of the alimentary mucous membrane. The same observer to whom we were originally indebted for this fact, Dr. Boehm, of Berlin, ascertained that the whitish layer which is often found covering the surface of the membrane, and to which reference has been made above, is of the same character. It is, indeed, nothing more than the epithelium, detached to a greater or less extent from the basement membrane, and adhering loosely to the bowel. This observation has been confirmed by a committee of the College of Physicians of Philadelphia, appointed to investigate the condition of the mucous membrane of those dying of cholera. They found the epithelium of the membrane, in all cases, either entirely detached, or adhering loosely as a pulpy layer, mixed with mucus or an albuminoid substance. The white matter contained in the prominent solitary glands, is probably the same epithelial tissue detached from the surface of the follicles. The villi are also denuded of epithelium.* But this derangement of the mucous epithelium is not confined to the lining membrane of the bowels. By an examination of the character of the cells in the discharges, it has been found to affect, more or less, the whole of the alimentary canal, from the fauces to the rectum. (Burnett, *Am. Journ. of Med. Sci.*, N. S., xviii. 283.) In the account of the urine and of the urinary mucous membrane in cholera, it was stated that the former contained epithelium from all parts of the urinary passages, and that the latter, whether of the kidneys, ureters, or bladder, exhibited the same consistent coating which is found in the bowels. This has, in like manner, been ascertained to consist of detached epithelium; and even the tubuli uriniferi are found gorged with imperfectly developed epithelial cells. Professor Walther, of Kieff, in Russia, has extended these investigations to the bronchial mucous membrane, and discovered in the frothy fluid found after death in the air passages, large quantities both of the flat epithelial cells of the pulmonary air vesicles, and of the cylindrical cells of the bronchial tubes; proving that the epithelial lining of these tubes, as well as that of the air vesicles, is very much disturbed. (*Arch. Gén.*, 4e sér., xxiv. 167.)

After death in the stage of reaction, the phenomena are entirely different from those of the collapse, but vary with the length of time which has elapsed from the commencement of that stage. The bladder has now resumed its dimensions, the viscid condition of the peritoneum, if previously existing, has disappeared, the venous injection has partially or wholly given way, the blood has lost some of its blackness and viscidity, though still not restored to its healthy state, and the rice-water contents of the bowels have given place to bilious and bloody fluids. Instead of the dark shade of venous congestion, there is now the vivid redness of unequivocal inflammation in the alimentary mucous membrane, which is also sometimes softened or otherwise changed; and the mucous follicles exhibit marks of incipient ulceration. Lesions in the various nervous centres and their investing membranes, such as might be expected from the symptoms during life, and not unfrequently evidences of inflammation of the lungs, are observed.

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* See the Report of the Committee in the *Summary of the Transactions of the College of Physicians of Philadelphia*, vol. iii. p. 35. The committee consisted of Drs. Samuel Jackson, John Neill, Henry H. Smith, and Wm. Pepper. Dr. Neill made the requisite anatomical injections and preparations.

Causes.—The essential and specific cause of this form of cholera is undoubtedly a peculiar epidemic influence. Various circumstances increase the susceptibility of the system to this influence; and many others hasten the attack, or call into operation a tendency originating in the specific cause, which without them might remain quiescent, and ultimately pass away. The former may be considered as *predisposing*, the latter, as *exciting causes;* but neither the one set nor the other, nor both combined, are alone adequate to the production of the disease; while the epidemic influence is capable of producing it altogether unaided.

The nature of the *specific cause* is unknown. In the minds of the speculative it has been vaguely associated with astral influence, the approach of comets, the conjunctions of the planets, various meteoric phenomena, the presence of ozone in the air, and peculiar electrical states of the atmosphere; but no facts exist to prove anything more than a mere accidental connexion between these circumstances and the appearance of cholera, and nothing certainly to authorize the suspicion, that they stand towards each other in the relation of cause and effect. That terrestrial exhalations of the nature of miasmata cannot have been the epidemic agent is inferrible from the fact, that the disease appears in ships at sea, in sandy deserts, and in the depths of a Russian winter. Chemical analysis, and the closest examination by the senses, have been able to detect no new ingredient in the cholera air, nor any deviation in the proportion of its ingredients from the ordinary standard. Some have been disposed to refer the results to invisible animalcules; and the apparently whimsical march of cholera—its rapid advances, long pauses, and sudden resumption of movement; its distant excursions from the regular line of march, its frequently capricious choice of localities, and the occasional deviation which it exhibits from every general rule of government—would seem to have some analogy with the uncertainty of will, which often characterizes animal migrations. In opposition to this hypothesis, the fact has been advanced, that the cause of cholera, whatever it may be, withstood the severity of the winter at Moscow; but this has less force when we consider the uniform heat maintained by the Russians in their vast houses, so that the supposed animalcules might be conceived not only to live, but even to propagate within the walls of a large city. The spread of the cause of cholera in opposition to winds, may also be thought to imply some inherent power of movement in the cause, such as belongs to animals. Another interesting fact, in its bearing on this point, is the influence of elevation on the operation of the cholera cause; the mortality from this disease being inversely as the height of the region affected.* The cause, if animalcular, would be apt preferably to occupy the lower elevations for two reasons, *first* that less effort is requisite to maintain the position, and *secondly* that the organic ingredients of the atmosphere which may be supposed necessary to support insect life are here most abundant. Still, it must be confessed that the opinion is entirely without proof; as these animalcules have never been detected. Equally without proof, though not without some plausibility, is the doctrine put forth and supported by Dr. Cowdell, that the disease has its origin in invisible atmospheric fungi. The reader need scarcely be told, that much interest was some time since excited by the asserted discovery of the choleric fungus in the air and the water of the vicinities where the disease prevailed, and in the evacuations of cholera patients; nor that this supposed discovery has been since entirely exploded by more accurate investigations. This epidemic influence is more analogous, in its movements, to that which produces the epidemic catarrh or influenza than to any other known cause of disease; but it differs also from that in its somewhat less rapid and much less sweeping march; the cause of cholera seizing only upon certain localities in its course, and leaving many others untouched, while that of influenza scarcely passes a spot, however secluded, without giving some evidences of its visitation.

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* In the Registrar-general's Report on cholera in England, for the year 1848-9, it is stated that the mortality, in the 19 highest districts, was 0.33 per cent. of the population, while in the 19 lowest it was 1 per cent., or three times greater; and, notwithstanding various disturbing influences, this inverse ratio was observed with remarkable exactness, even with differences of elevation not exceeding 20 feet. (See *Brit. and For. Med.-Chir. Rev.*, July, 1852.)

The hypothesis that cholera is propagated by contagion has not been without numerous advocates. In favour of this the facts have been adduced; 1. that it travels along the lines of commercial intercourse, as in the course of large streams, in the track of caravans, and from port to port across seas or oceans; 2. that its rate of advance never exceeds the possible rapidity of human progression; 3. that its occurrence often succeeds the arrival of an infected ship, caravan, or corps of marching soldiers; and 4. that its attack is not general in the beginning, but, whether in a city or particular family, one or a few are seized at first, and then others successively, as if the cause had passed from individual to individual. But it will be perceived that these are not proofs of contagion, but only evidences, so far as they go, of the possibility, or at best of the probability of its existence; and it is not difficult to explain them without recourse to such an hypothesis. Thus, if the disease prefer the course of streams, this may well be in consequence of the known affinity of its cause for low, damp, and marshy situations; if it is observed especially along the routes of inland trade, this may be owing to the circumstance, that the largest and most conspicuous towns, which it is apt to select, are upon these routes, while remote spots which it also visits are less open to observation; if it pass from an infected port to other transmarine ports between which there is commercial intercourse, the fact could scarcely be otherwise if it travel at all, so intimately are all parts of the world associated in the meshes of a universal traffic; if its arrival is often preceded by that of a ship or of travellers from an infected place, this may well be the result of accident, and very often no such connexion can be traced, while intercourse of the kind is constantly carried on, without the conveyance of the disease; and, finally, if it sometimes attack one person after another, instead of all simultaneously, this is nothing more than often occurs in the operation of morbid causes confessedly non-contagious, and is not always true of cholera, which occasionally prostrates multitudes at one blow. The case made out by the contagionists, therefore, fails of adequate proof. There are circumstances, moreover, in the course of cholera, which cannot be explained upon their hypothesis. If propagated by contagion, why should the disease at one time march with an awful rapidity, and at another halt for years upon the confines of countries, open to a constant intercourse with the infected territory? Why should it suddenly seize upon a certain district, rage fiercely for one or two months, and then leave it altogether? Why should it attack large cities, and often let the surrounding and closely associated rural villages go free? How, in fine, does it happen that a distinct line is sometimes drawn between the infected and uninfected neighbourhoods; that a low damp spot is desolated, while a neighbouring height is in safety; that even the upper and lower stories of the same house should be in opposite conditions in this respect; while in all these cases there is no suspension of intercourse? The strictest quarantine regulations have often signally failed. The disease has laughed at walls, guards, and legal penalties.[*] It may be said that, like scarlet fever, it might have been the result of an epidemic cause, and yet capable of propagating itself by contagion after it had been produced. But attempts of the most varied kind have been made to impart it by inoculation, and by introducing its different products in every way into the system, altogether without success. The sucking infant has failed to receive the disease from its mother. Physicians and other attendants upon the sick are not attacked in larger proportion than the rest of the population of the same class, similarly exposed in other respects. In hospitals situated in uninfected neighbourhoods, the attendants escape altogether. Individuals affected with the cholera do not become centres of a new infection, when removed to healthy situations. Some few instances have been adduced in opposition to this statement; but their force is entirely lost in the overwhelming numbers of those which might be advanced in support of it; and the very incidents so much relied on are, in fact, either misinterpreted, or offer only such coincidences as happen in all epidemics, and have led to the belief, at one time or another, in the contagiousness of every epidemic disease, even of influenza. When the disease invades cities, it very generally attacks individuals in quick succession, at distant points, and without any previous communication. Thus it acted in London[†] in 1848, in Philadelphia[‡] in 1849, and in Memphis[§] on the Mississippi in December, 1848. The facts above given are, I think, sufficient to prove that the disease is in no degree contagious.

Perhaps it may be thought, on first view, that the occurrence of cholera at New York and New Orleans, in December, 1848, affords proof of its propagation by contagion. I think that exactly the reverse is the case. The reader is requested to revert to the short history of those two invasions of the disease already given. A ship sails from Havre for New York; the people of the former town, and her own crew and passengers being quite free from the disease. When sixteen days at sea, she is attacked with cholera. Assuredly, the disease could not have arisen, in this instance, from contagion. Even the sixteen days, without claiming a longer exemption from any possible exposure, are too long a period of incubation to admit of this idea. She arrives at the quarantine ground and lands her passengers. A few persons are attacked with cholera in the vicinity. But, according to the report of the attending physician, it was not the individuals most exposed to the sick who were especially attacked.* Nor did the disease spread in Staten Island beyond the boundaries of the quarantine, though more than one hundred of the passengers scaled the walls, and were distributed in the villages around. Three cases only occurred in the city of New York, one of which was in a crowded and filthy house containing two hundred inmates, among whom the disease did not spread.† In a short time, the disease disappeared both from Staten Island and the city. These facts appear to me to be incompatible with the idea of contagion. Certainly, there is no other contagious disease which would have pursued the same course. It may be said that the contagion is inoperative in cold weather. If so, it is the only known and admitted contagion that is so. Again, it may be said that the contagion is effective only in certain favourable conditions of the atmosphere. The same reply may be made, that the fact is true of no other. At the utmost, all that the advocates for contagion can claim from the above incidents is, that the disease has an extremely feeble power of propagation, which can operate only under circumstances peculiarly propitious to it. But what of the vessel which sailed from the same French port to New Orleans? In this, the passengers were not attacked until they had been at sea twenty-six days. It is utterly impossible that they should have brought the disease with them from Europe. On their arrival at New Orleans, the cholera broke out in a very few days, and with a fearful rapidity spread not only through that city, but through the valley of the Mississippi. Never did contagion propagate itself so rapidly as this. If this was the cause of the spread of cholera on that occasion, it must be infinitely the most contagious disease that was ever before known, immeasurably more so than smallpox, itself perhaps the most contagious of all diseases. How can this idea be reconciled with the incidents at New York? To believe that cholera was propagated by contagion in these two instances, is to believe that it is at once the most and the least contagious of all known maladies. How then, it may be asked, can the occurrences on these two occasions be explained? Simply, thus. The cause of cholera, whether organic or inorganic, is self-propagating. In favourable states of the air, it has the property of producing its like, and that with the rapidity of animalcular reproduction. The two vessels, departing from a healthy port in Europe, entered at a certain period of their passage the cholera atmosphere, which, in the regular progress of the epidemic, was making its way westward over the Atlantic. With this atmosphere, impregnated with the germs of the cholera cause, the whole capacity of the two vessels was thoroughly imbued. They outsailed the advancing column of aerial poison, and carried the germs of it with them to the places of their destination. At Staten Island, these germs propagated in the air; but the reproduction soon ceased, either through the influence of cold, or from the want of a due medium for the process. At New Orleans, on the contrary, finding favouring influences in the hot weather, and probably in the state of the atmosphere, the cause multiplied with vast rapidity, and, being carried by the steamboats up the river, diffused itself in the towns which stud the banks of that river and its tributaries. It did not cross the Alleghanies, because there were no boats to convey its aerial germs over the hills. Individuals, in numerous instances, brought the disease with them to the villages on this side of the mountains, and died with it; but they did not propagate it, because it is not capable of being propagated by contagion. It is not impossible that individuals, fresh from a highly charged cholera atmosphere, may carry the germs with them, in their clothing, for a short distance, and thus be the means, in some rare instances, of spreading the disease; but this is not contagion. The effect would ensue as well from a healthy as from a diseased person. It will be remembered that, in the spring of 1849, the epidemic attacked the Atlantic sea-board, and thence spread into the interior. This was in the regular course of its progress. The column of morbific influence through which the ships had passed, and which they had outsailed, had now reached our continent. I have dwelt longer on this subject, because of its importance. A belief in the contagiousness of cholera has done vast mischief by bringing our fears into conflict with our duties to the sick; and it is, beyond all calculation, important to the interests of humanity, that this dread of contagion, if really unfounded, should be believed to be so.

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[*] In the summer of 1850, I was in Stockholm; and at that time there was not a case of cholera in that city, or, so far as was known, in all Sweden. It had, however, reached the opposite coast of Finland in its westward march from Russia. The most rigid quarantine regulations were inflexibly enforced to prevent communication with the places where cholera prevailed, sufficient to exclude any contagious disease, even smallpox. I had occasion to leave Sweden, and was absent for a month in Russia, and other parts where cholera more or less prevailed. On my return, though the steamboat in which I was a passenger had no case of cholera on board, and had never had any, yet, as she came from a port supposed to be infected, she was placed in quarantine in the bay more than twenty miles from Stockholm, and none of the passengers were allowed to go beyond the limits of a small uninhabited island, which constituted the quarantine ground. Here I remained till the boat returned to Prussia. Yet at that very time the cholera had broken out in Stockholm, and soon raged with great violence. It had passed over the gulf directly from Finland, wholly regardless of the legal obstacles. (*Note to the fourth edition.*)

[†] Parkes, *Lond. Med. Gaz.*, July, 1849, p. 157.

[‡] Condie, *Am. Journ. of Med. Sci.*, N. S., xix. 457.

[§] Shanks, *Ibid.*, xviii. 13.

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* See a communication by Dr. Sterling, in the *New York Journ. of Med.*, N. S., iii. 25.

† *New York Journ. of Med.*, N. S., ii. 97.

The *predisposing causes* are very numerous. Whatever is calculated to diminish the vital energies, or to reduce the vital actions below the standard of health, may be ranked among these causes. Not only are debilitated individuals in greater danger when labouring under the disease; they are also much more liable to its attack. Previous disease, old age, intemperance, vicious indulgences of all kinds calculated to impair the health, deficient alimentation, an exclusive vegetable diet, confined air, especially in low and damp places, the effluvia of crowded residences, continued grief, fear, anxiety, and other depressing emotions; all these predispose to cholera.

Nor are the *exciting causes* less numerous. Indeed, the two sets of causes often act interchangeably, those which in some cases excite the disease, producing a predisposition to it in others, and *vice versâ*. Whatever makes a sudden and powerful impression on the system, and whatever irritates the stomach, may convert a tendency to cholera into its reality. One of the most common exciting causes is a sudden exposure to cold when the body is warm and perspiring. Hence, in part, the injurious effects of the night air and of damp places. Sudden and strong emotions often bring on an attack. Indigestible food, such as unripe fruit and crude vegetables; excessive eating even of wholesome food; unwholesome drinks, including impure water, cider, poor wines, and imperfectly fermented liquors of all kinds; very cold drinks and ices taken too freely, especially when the body is heated; purgative medicines, particularly those of a drastic character; these, and many other causes, operating in a similar manner, are capable of exciting the disease in persons previously exposed to the specific influence.

From a combination of these causes it is, that the ravages of cholera have been experienced especially by the poorest and most wretched of the population, in every country; by the intemperate, the debauched, the ill-fed and ill-clothed, the badly lodged, the over-worked, the tenants of prisons and almshouses, the inhabitants of crowded and filthy suburbs, or of miasmatic districts, soldiers fatigued by long marches, sailors shut up in the holds of ships, and garrisons crowded in damp and badly provided camps or fortresses. In India, the natives, who live chiefly on vegetable food, suffered much more than the Europeans. In Havana, the proportion of deaths to the population was, among the coloured people in general, more than twice as great, and among the free African negroes, who are probably the worst provided, about four times as great as among the whites. In cities, it has almost always been the lowest, dampest, most crowded, and most filthy sections that have suffered first and most. In general, the well provided classes of society have suffered little in any country, though there have almost everywhere been occasional exceptions to this rule. The ravages in different countries or sections of the globe have borne, in general, an inverse proportion to their well-being. Thus, Asia has suffered more than Europe, and Europe more than North America.

The time requisite for the production of cholera, after exposure to the epidemic cause, is indefinite, but often very short. Instances are on record, in which persons, arriving in perfect health in an infected neighbourhood, have been attacked within two or three days, and even within a single day from the time of their arrival.

Nature.—The most opposite opinions have been entertained as to the nature of the disease. While some have maintained that it was essentially irritation or inflammation of the alimentary mucous membrane, and that all the phenomena have their root in this primary affection; others have associated with this pathological condition, as the direct result of the same cause, a deranged state of the nervous functions, and especially those of the ganglionic system; and others again have rejected altogether the notion of gastro-enteritis, ascribing the phenomena to the combination of a sedative action of the specific cause upon the functions of organic life, with an irritant action upon those of animal life. (Hodge, *Am. J. of Med. Sci.*, xii. 386.)

That an irritation of the stomach and bowels exists in cholera can scarcely be doubted. How else can we explain the great abdominal uneasiness, the frequent burning pain in the epigastrium, the antecedent diarrhœa, nausea, and vomiting, and the unequivocal evidences of positive inflammation which are presented after reaction, both by the symptoms and upon dissection? How else, moreover, explain the action of the various exciting causes, most of them of a directly irritant character? Is it not by producing or augmenting irritation, that indigestible food, and active cathartics so often induce an attack of the disease? But that the affection is a pure gastro-enteritis, appears to be contradicted by all the results of previous observation. We have long been familiar with every shade and variety of inflammation of the alimentary mucous membrane; but when had we ever before met with the phenomena of malignant cholera? Every candid practitioner will, I think, admit that, though he may have seen instances of disease bearing some analogy with this, it struck him, on the whole, when he first saw it, as something new to his experience. Examination of the bodies of those who die in the cold stage reveals no uniform and unequivocal evidences of inflammation. The injection of the mucous membrane is venous. The same injection is found, though in a less degree, in the skin, the bronchial tubes, and the parenchyma of various organs. The apparent deposit upon the surface of the membrane is not fibrin, but mainly the epithelium, separated by the gushing forth of the watery liquid from the blood-vessels. The vesicular appearance noticed by Dr. Horner is probably owing to the same cause. The enlargement of the intestinal follicles may depend in part on congestion, in part on the separation of epithelium. Besides, in some cases of speedy death, no signs whatever of organic change are observed, to which the symptoms could be ascribed. Inflammation takes place after reaction, and sometimes proves fatal; but the proofs are wanted of its existence, in any considerable degree, during the first stage, or that of collapse; and the probabilities are wholly against it. If there is so violent an inflammation as to produce death in a few hours, how does it happen that the simple measures employed often so readily arrest it, upon the borders of collapse? Do we see inflammation of such intense severity give way so easily under other circumstances? If these considerations are of much weight, the inference is, that in cholera there is an irritation, sometimes possibly a moderate or partial inflammation of the gastro-intestinal mucous membrane; but not that intense degree of inflammation which would be implied by the notion that it was the essential basis of the disease. But, admitting the existence of irritation, we shall not find this sufficient to account for the phenomena.

Even supposing it to be directed especially to the secretory function, still, it is contrary to all our experience of this affection, that it should produce and sustain a secretion so immense in amount, continuing too, even when the pulse has almost ceased to beat, without the co-operation of some other morbid derangement. Besides, the excess of secretion is not confined to the alimentary canal. The perspiration is in some instances scarcely less profuse; yet no one could suppose the existence of cutaneous inflammation. A whitish coating, similar to that of the alimentary mucous membrane, is often found also in the urinary passages; but these are not supposed to be irritated or inflamed. There is some cause, therefore, disposing to this excessive elimination of watery liquid, and especially to this exfoliation of the mucous epithelium, other than a mere excess of excitement. What this cause is, or how it operates, is not so easily determined. The probability is, that a poison is taken into the system, capable of producing a profound impression on all its parts; and that, among its effects, is either such a relaxation of the exhaling orifices as to admit the ready passage of the more fluid parts of the blood, and sometimes of the red corpuscles themselves, or such a modification of the circulating fluid as to cause it to pass through the structures which ordinarily retain it, or else a combination of these two conditions. It is also highly probable that other phenomena in the disease are due to the same unknown cause. It is true that the immense loss of fluid from the alimentary canal and skin will account for most of the symptoms of the collapse. The blood is thus rendered black, thick, and viscid, and circulates with difficulty through the vessels. It loses its capacity of absorbing oxygen, and, no longer changing from venous to arterial, ceases to support the temperature of the body, or to stimulate the heart to contraction. Hence the failing circulation, the stagnation in the capillaries, the blue skin, the feeble and hurried respiration, and the universal coldness. The more elaborate secretions, as those of the bile, urine, and tears, cease because the serous part of the blood finds an easier outlet through the exhaling surfaces. The whole body shrinks from the exhaustion of its fluids; and the same cause gives rise to the intense thirst, which is only the want of the whole system expressing itself through the fauces. But the nervous phenomena do not admit of the same solution. It is quite doubtful whether they depend upon the condition of the alimentary canal, as they are often worst when that structure is least obviously affected. Nor is it certain that the symptoms of collapse are always dependent on the alvine discharges. It is not improbable that the exfoliated condition of the epithelium in the pulmonary air vesicles may contribute to it, by preventing the due circulation and change of blood in the lungs, and thus producing a true asphyxia. Cases have frequently been noticed, in which fatal collapse occurred with little or no evacuation from the stomach and bowels; and though, in these cases, the same peculiar fluid was found in the bowels after death, yet the quantity was scarcely sufficient to account for the symptoms. We are driven, therefore, to the supposition, that the poisonous cause is capable of producing all the characteristic phenomena of cholera by its direct action. What is the precise nature of this action cannot be said; but the nearest approach to a rational explanation appears to me to be that which considers it sedative to the system at large, especially to the functions under the control of the organic nervous centres, but irritant to the alimentary mucous membrane, and perhaps to the mucous membranes generally. This is similar to the poisonous action of tartar emetic, which depresses the circulation, while it irritates the lining membrane of the stomach and bowels; and the case of disease, which, within my observation, has approached nearest to the collapse of cholera, and which resembled it so closely as to have been mistaken for it at first by a practitioner who had much experience in the complaint, occurred in a female who had taken a poisonous dose of that antimonial.

By many, the epidemic cholera is believed to differ from ordinary cholera only in its violence. There is undoubtedly considerable resemblance between the two affections; but I nevertheless believe them to be distinct. In cholera morbus the evacuations are generally bilious, in epidemic cholera they are rarely so. This difference has been ascribed to the greater severity of the latter complaint; and it is stated, in support of this view, that bile often appears in the discharges of epidemic cholera, when it begins to moderate. But the distinctive sero-albuminous character of the dejections in this affection is observed even in very mild cases, which yield readily to treatment, and which are certainly less violent than the higher grades of cholera morbus. Were the two affections identical, there ought to be a point, in their respective gradations of severity, in which they should exactly coincide. Though I have seen much of cholera morbus, both in public and private practice, I have not met with a case exhibiting exactly the rice water evacuations of the epidemic disease. There is often great and sometimes fatal prostration in the former affection; but the blue skin, the shrivelled extremities, the universal shrinking away of the flesh, and the peculiar mental apathy, are generally, if not always wanting; and the neuralgic and spasmodic symptoms, if present, are so in a much less degree. The differences in the seasons at which they occur, and the persons they attack, the situations they respectively affect, their cause, course, and termination, are other reasons for considering them as essentially distinct affections.

Prognosis.—Treated in the forming stage, while yet in the state of diarrhœa or cholerine, the disease can almost always be arrested. Even when completely formed, if not advanced to the stage of collapse, it terminates favourably, under appropriate management, in the vast majority of cases. But in the collapsed state, with the fluttering or absent pulse, the cold and leaden surface, the suspended capillary circulation, the sunken and inexpressive features, and complete mental apathy, the patient is already in the grasp of death, and medicine can be of little avail. Very few rise out of this condition, when completely formed; and the danger is in proportion to the degree in which it is approached. From the rapidity of the disease, and the destitute state of many of those most exposed to it, the patient is very often reduced to this condition of collapse before medical aid can be obtained. Hence the great mortality of this fearful epidemic. The published reports of cholera often have reference to the disease as witnessed in hospitals, or other public institutions, where the worst cases are crowded together, and not unfrequently in the last stage. The inmates of these institutions are, moreover, very frequently of the classes least able to resist the complaint; such, namely, as are already debilitated by age, disease, want, excessive fatigue, or intemperance. Among these, cholera has always made terrible havoc. It is not surprising, therefore, that the published records give a fearful proportion of fatal cases. In some instances, almost all seized with the disease have perished. Out of 1,387 patients at Dantzic, during the first epidemic, only 377 recovered. Of those attacked in the Polish army more than one-half died. The same was the case in the hospitals of Paris. About one-half of the reported cases died in London. In New York, the ratio of deaths was one-half, in Philadelphia, one out of two and a half. (*Am. Journ. of Med. Sci.*, xi. 292.) But this gives an unfair view of the mortality, at least as the disease prevailed in the United States; for a great number of moderate cases which recovered were not reported. From my own observation, and the published statements of others in relation to their private practice, I should infer that the proportion of recoveries, even from well-marked cases of the disease, was vastly greater than that above given. In almost all instances, the amount of fatality was greatest at the commencement of the epidemic, and gradually declined with its continuance. It was no uncommon circumstance for almost every individual to perish of those who were first attacked. The rate of mortality in subsequent epidemics has been, on the whole, very nearly as in the first.

In forming an estimate of the probable result, in any particular case, all these circumstances are to be considered. In the early stages, before the symptoms of collapse have come on, in a young or middle aged, previously healthy and robust individual, and especially if the case occur in the decline or towards the close of the epidemic, a favourable termination may be reasonably expected. If, during the collapse, the pulse begin to rise, the skin to become warm, and the secretion of bile and urine to return, there is hope for the patient; though, in giving an opinion, it is necessary to bear in mind the great dangers of the stage of reaction. When the attack is violent, and hastening into collapse, or this condition has already occurred, and when the seizure has taken place at the commencement of the epidemic, in an individual more than fifty years old, or previously much debilitated from any cause whatever, the most serious consequences are to be apprehended. Dryness of the cornea, ecchymosis of the conjunctiva, and a perfect stasis of blood in the capillaries, as indicated by the want of any change of colour in the gums or inner surface of the lips upon pressure with the finger, are certain signs of approaching death.

Treatment.—The plans of treatment which have been employed in epidemic cholera are almost as numerous as the combinations of which remedies are susceptible; and, judging from the reports upon a great scale, there seems to have been little difference in the results; for the proportion of deaths has generally varied from one-half to one-third, no matter what was the locality, or what the means of cure resorted to. This apparent uniformity has no doubt arisen in part from the circumstances, that, of the cases reported, a very large proportion was utterly beyond the reach of remedies, and that, in any particular place, the favourable and unfavourable results of the different modes of treatment pretty nearly counterbalanced each other. When, however, a discriminating view is taken of the whole ground, and the published results of individual practitioners or individual institutions, in connexion with the treatment employed, are compared, we still find insuperable difficulties in coming to a just conclusion as to the most effective plan; great success being often claimed for the most different, and even opposite remedies, by their respective advocates. In deciding, therefore, for himself, the physician is necessarily thrown off of the ground of general experience upon that of principle, and his own individual observation. I shall first give a sketch of the plan of treatment suggested by a judgment formed upon this basis, and afterwards a detail of various other plans, recommended by their apparent merits, or the testimony in their favour.

In the absence of any certain pathology of the disease, the efforts of the practitioner should be directed to the correction or removal of obvious disorder of the functions, and thus to put the system as nearly as possible into its normal condition. The indications of treatment, in the first and second stages of the disease, deducible from the obvious phenomena, are to arrest the evacuations from the stomach and bowels, to relieve irritation of the gastro-intestinal mucous membrane, to restore the suspended secretions, especially that of the liver, to equalize the circulation, to relieve the nervous disturbance, and to support, when necessary, the general strength. Of these, the most important is to arrest the alvine evacuations; for it is by their continuance and increase, that the fatal condition of collapse is generally induced. But the measures best calculated to answer this indication are such as will meet, to a certain extent, most of the others also; as the evacuations, if not the result of the irritation, are probably promoted by the sanguineous congestion which it induces; and the restoration of the suspended secretions, and the equalization of the circulation, must have a tendency to diminish this congestion.

Among the remedies best calculated to meet the above indications are opium and calomel, in small and frequently repeated doses, combined, when the discharges are copious, with acetate of lead, and, in addition, if this should prove insufficient, with tannic acid, kino, catechu, or the extract of rhatany. Very large doses of opium are considered, and probably are injurious, by obtunding the nervous system below the point of necessary impressibility, and thus inducing torpor and even coma, and favouring congestions of the brain and other great internal organs. In moderate doses, on the contrary, it proves highly useful by checking exhalation into the bowels, determining to the surface, relieving pain and allaying irritation, and sustaining a gentle, general, diffusive excitement. Minute and frequently repeated doses of calomel have the effect of stimulating the hepatic secretion, without irritating the stomach. It is, indeed, highly probable that they have a tendency directly to allay gastric irritation; and, if the general mercurial influence is induced, it may prove useful not only by changing the existing morbid action, but also by obviating, in some degree, the danger of inflammation in the fourth or last stage. The mercurial pill may often be advantageously substituted for calomel, in equivalent doses. Acetate of lead acts by the combination of astringency with a directly sedative influence upon the mucous membrane; tannic acid, kino, catechu, and extract of rhatany, by their astringency alone. The mutual reaction of these substances, though resulting in the formation of new compounds, does not by any means necessarily imply a therapeutical incompatibility. In relation to the combination and exact dose of the above remedies, the practitioner must be guided by the degree of severity, and the peculiar circumstances of each particular case. In the mildest cases, opium and calomel may be employed alone; in those of a higher grade, the acetate of lead should be added; and in the most obstinate, all should be given simultaneously. The dose should be such as to admit of repetition every half hour or hour, during the height of the disease; after which the interval may be gradually lengthened.* From one-twelfth to one-half of a grain of opium, from one-sixth of a grain to one grain of calomel, from one-third of a grain to two grains of acetate of lead, and from two to five grains of kino or extract of rhatany are suitable quantities; and they are best given in the pilular form. The first dose or two of opium may be larger, say from half a grain to a grain or more in threatening cases, in order to produce a prompt impression, which may be afterwards sustained, if necessary, with the smaller doses.

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* The following are convenient formulæ. R.—Opii pulv. gr. j; Hydrarg. Chlorid. Mit. gr. ij; Acaciæ pulv., Syrup., āā q. s. Fiant pil. no. xii. S. One every half hour, or every hour. ℞.—Opii pulv. gr. j; Hydrarg. Chlorid. Mit. gr. ij; Plumb. Acetat. gr. xij; Acaciæ pulv., Syrup., āā q. s. Fiant pilulæ no. xij. S. One every half hour, or every hour. R.—Opii pulv. gr. j; Hydrarg. Chlorid. Mit. gr. ij; Plumb. Acetat. gr. xij; Kino pulv. ʒj; Acaciæ pulv., Syrup., āā q. s. Fiant pil. no. xxiv. S. Two every half hour, or every hour. It should be recollected, as stated in the text, that, in urgent cases, a larger dose than any above indicated must be given at first, so as to produce a prompt impression, which is afterwards to be maintained by the smaller doses. Thus, the first dose or two may consist of half a grain or a grain of opium, with two grains of calomel. The blue mass may, in either of the formulæ, be substituted for the calomel in three times the quantity; but it is generally less efficient.

During the administration of the above remedies, the patient may be allowed to swallow frequently very small quantities of cold carbonic acid water, which tends at the same time to relieve the burning thirst, and allay the vomiting. If this cannot be had, small doses of the effervescing draught may be substituted. A little very cold water every now and then, or small pieces of ice, will be found very grateful to the patient. Whatever liquids are administered should be cold, as heat increases the thirst, and already intolerable burning of the stomach. Lime-water and milk are sometimes useful in allaying the gastric irritation; and some of the aromatic waters may be employed for the same purpose. In cases requiring stimulation, the aromatic spirit of ammonia will often admirably answer both indications. At the same time, a sinapism of pure mustard should be applied over the epigastrium; and the effects of opiates given by the mouth should be aided by enemata of from forty to sixy drops of laudanum, with mucilage or thin starch. I wish particularly to impress on the young practitioner the importance of an early resort to the sinapism and anodyne enema, as here advised.

To equalize the circulation and nervous excitement, efforts should be made to bring about action upon the surface of the body. For this purpose, dry heat, and moist heat by means of the warm bath or vapour bath, have been recommended. These may sometimes be advantageous in the earlier stages; but, at a more advanced period of the disease, when they would seem to be yet more strongly indicated, experience has not pronounced in their favour. Though the surface may be cold, the patient has not unfrequently an opposite feeling, and suffers greatly from hot applications. These, moreover, are apt to increase the perspiration, already in many instances exceedingly abundant, and thus to aid the alvine evacuations in the exhaustion of the serous portion of the blood, and consequently to hasten the collapse. Hot pediluvia, rendered stimulating with mustard, Cayenne pepper, or common salt, may be used in all cases in which the extremities merely are cold. The best mode of effecting a centrifugal excitement is by moderate frictions over the surface, either by the hand alone, or with flannel, coarse towels, or a flesh-brush, or in connexion with rubefacients. Care must be taken to avoid injury to the skin by the violence of the friction. This remedy often affords great relief to the cramps. Frictions over the whole surface of the body with mercurial ointment, mixed with half its weight of camphor, and one-quarter of its weight of Cayenne pepper, urged to salivation, were employed with the happiest results by Dr. Lee, of New York. (*Am. Journ. of Med. Sci.*, x. 544.)

Peculiar circumstances may require additional remedies. In those rare cases in which the pulse is full and strong, especially if connected with convulsive symptoms, blood should be taken from the arm. Leeching to the epigastrium is indicated in the earlier stages, when there is tenderness with burning pain in the stomach. Prostration must be obviated by the diffusible stimulants, especially in intemperate persons, though little good can be expected from these remedies in the state of collapse. Tincture of camphor, aromatic spirit of ammonia, and the ethereal preparations are among the best. Sound port wine or brandy diluted with cold water, and impregnated with mint or other aromatic, may also be used, though with caution. The camphorated tincture of opium is admirably adapted to mild cases of the disease, or to its earliest stage. The cramps may sometimes be relieved by steady and firm extension of the affected muscle.

The above remedies must of course be graduated to the severity of the case; and, in the forming stage, while the disease is yet in the state of diarrhœa or cholerine, it may not be necessary to resort to any other remedy than an opiate, with or without calomel or the blue mass, according as the hepatic secretion is or is not deficient. It is, however, of the utmost importance to arrest the disease in this stage, and the simple measures necessary for this purpose become highly valuable remedies. When the stools retain the natural colour, a teaspoonful of the camphorated tincture of opium three or four times a day, or from five to ten drops of laudanum with a few drops of tincture of camphor, repeated as often, will very frequently be sufficient, along with a proper regimen, to check the preliminary diarrhœa, and thus ward off an attack of the cholera. Should the stools be white, or very light-coloured, the mercurial should be conjoined with the opiate in alterative doses. Should the stomach be loaded with undigested food during the forming stage, the treatment may very properly be commenced with a gentle emetic of ipecacuanha. Should costiveness follow the use of the means requisite for checking the disease, it should be corrected by the mildest possible measures; and rhubarb is perhaps the best laxative for the purpose.

In the stage of collapse, the same indications are presented as in the previous stages, with two additional; namely, to check the excessive sweats, and to supply the loss of watery fluid and salts which has been sustained by the blood. There would seem to be even a stronger call for active stimulation; but experience has shown that this measure should be employed with some reserve. In the existing state of the circulating fluid, it can be of little avail, and, when carried too far, it has the effect of still further aggravating the danger, by increasing the already excessive sweats, and exhausting the little remaining excitability of the system. It cannot possibly restore the lost epithelium of the bowels, and may possibly sometimes aggravate the inflammation which must necessarily ensue. The stimulants, however, already mentioned, may be used in small and frequently repeated doses, and continued if found productive of no ill effects. The efforts to restrain the evacuations from the stomach and bowels, if these continue, should not be abandoned; and, though external heat has been found productive of little good, attempts should still be made to excite the surface by frictions and rubefacients. Sinapisms may be applied to the abdomen and extremities, and Cayenne pepper and brandy, oil of turpentine, tincture of camphor, liniment of ammonia, &c., over the surface of the body. Hot baths, rendered stimulating by common salt, mustard, capsicum, &c., have been recommended. To close the cutaneous exhalant orifices, astringent solutions may be employed, as of alum with brandy; and for the same purpose, as well as indirectly to excite the skin, frictions with ice or iced-water have been strongly recommended, and are often very grateful to the patient. Under the reaction from the cold application, the blueness of the surface gives way to a glowing redness, the temperature is elevated, and the pulse, which may have been quite wanting in the wrist, sometimes returns; but the improvement is too often only temporary. To repair, as far as possible, the loss of water and soluble salts by the blood, the patient should be allowed to drink frequently of carbonic acid water with bicarbonate of soda in solution, weak animal broths with salt, iced-water, iced brandy and water, gum-water, barley-water, &c.; and injections of salt water with laudanum may be occasionally thrown up the bowels. With the same object, saline baths have been employed by some.

When *reaction* has begun, the stimulants should be moderated or withdrawn, and attention confined chiefly to the correction of the quality of the blood by the continued use of suitable drinks, and to the obviating of any local irritations which may appear.

When reaction is established, the treatment must be made to conform to the variable morbid conditions presented, and must be guided by the general principles applicable to other affections. One fact, however, must be borne in mind, that the inflammations which are apt to occur cannot, in consequence of the previous exhaustion, be treated with the same activity of depletion as under ordinary circumstances. Blood must be cautiously abstracted, and cupping or leeching is in general preferable to the lancet. Reliance must be placed chiefly upon fomentations, blisters, the mercurial impression, and a properly regulated regimen. If a typhoid state of disease appear, it may be necessary to have recourse to tonics and stimulants, as sulphate of quinia, serpentaria, carbonate of ammonia, wine-whey, oil of turpentine, &c., as employed in the ordinary typhoid fever.

Attention to the diet is very important. In the preliminary diarrhœa, while the appetite continues in a greater or less degree, the food should be of the least irritating and most digestible kind. Stale bread, crackers, boiled rice, milk, cream, light broths, and boiled meats of easy digestion (see *Dyspepsia*), may be employed. When the disease is established, the diet should consist of mucilaginous and farinaceous liquids, or very weak chicken or mutton water. Milk, in very small quantities, with lime-water, sometimes proves useful both as food and medicine. During convalescence, the utmost caution should be observed to avoid indigestible, flatulent, or irritating substances. The farinaceous preparations, and the lighter kinds of animal food, should be preferred. The dietetic rules given in dyspepsia and chronic gastritis are applicable here.

Much may be done by proper *prophylactic measures* to avoid the disease or render it milder. The diet should be such as to preserve the digestive organs, and the general system, in the soundest possible state, so that they may be neither over-stimulated nor depressed. It should consist of a mixture of vegetable and animal food, avoiding indigestible, flatulent, acid, and irritating substances, but admitting the more digestible fruits, when not forbidden by an already debilitated or irritated condition of stomach. They are useful by obviating costiveness, and the consequent necessity for the use of cathartic medicines. All those drinks should be shunned, which have been mentioned as exciting causes of the disease. Habits of temperance both in eating and drinking are all-important; but, for an individual accustomed to the use of stimulating drinks or food, there might be some danger in a sudden change. A moderate elevation of the vital functions is preferable to their depression; and hence the use of gentle stimulants, such as ginger, mustard, black and Cayenne pepper, in moderation, may prove serviceable. An equable state of mind should be preserved as far as possible; and excessive fatigue, sensual indulgences, exposure to sudden changes of temperature, and especially to the damp night air, should be avoided.

In relation to the various plans of treatment, not included in the above statement, a very general sketch must suffice. Bleeding in all stages of the disease, even in that of collapse, has been the remedy chiefly depended upon by some practitioners. Others have placed great reliance upon emetics of ipecacuanha, mustard, or warm brine; and even purgatives have found their advocates. Nitrate of silver in solution, by the mouth and the rectum, is said to have proved highly beneficial in some cases. It has been given in the dose of one, two, or even three grains, dissolved in one or two fluidounces of water, in cases of approaching collapse, with the apparent effect of arresting the disease. Great success has been claimed for the officinal diluted sulphuric acid, of which twenty minims may be given with a little aromatic addition, in a wineglassful of water, and repeated after each act of vomiting, or each copious stool, or at intervals of four hours. A mixture of sulphuric and nitric acids has been used, under the name of the Austrian specific. Strychnia, administered in the collapse, is stated to have great power of producing reaction; and, though most of the patients die subsequently, yet a more than usual proportion of recoveries from that condition takes place. Thus, out of 22 cases to which this medicine was administered, 19 reacted, and of these only 9 died. (*Archives Gén.*, Aug. 1854, p. 234.) In the East Indies, and subsequently in some parts of the United States, calomel in large doses, with or without opium, has been a favourite remedy; and the quantities administered with impunity, in certain cases, would seem scarcely credible, were they not well authenticated. Frequent draughts of hot water have been highly lauded, as constituting the most effectual treatment, by one practitioner; while another has spoken, with equal confidence, of the almost exclusive use of cold drinks and cold water, or ice applied externally. Some have relied upon opium, brandy, and other stimulants; the school of Broussais, on the contrary, upon cool and demulcent drinks, leeches to the epigastrium, and the external use of fomentations and rubefacients. Great success has been claimed for a treatment, in which the prominent measure was the application of irritants over the spinal column; ammonia, oil of turpentine, or a heated flat-iron, being employed for the purpose. The doctrine of Stevens, that the salts of the blood are essential agents of its arterialization, taken in connexion with the supposed loss of these salts by the evacuations which occur in cholera, has led to the use by some of the non-purgative salts, such as bicarbonate of soda, chloride of sodium, chlorate of potassa, &c., as the main remedial measure. From the same idea of restoring to the blood the constituents lost during the disease, originated the practice of injecting into the veins, during the collapse, large quantities of warm water, holding common salt and carbonate of soda in solution, in the proportion in which these salts are found in the serum of the blood. The happiest effects seemed for a time to result from this remedy; the pulse returning, the surface assuming its natural colour and fulness, and the patient reviving into the appearance of convalescence; but the evacuations recurred, and collapse generally ensued, followed by speedy death. The general result of experience as to this plan of treatment has been, that, though in a very few instances recovery has taken place under it, from a state of collapse, yet these instances have scarcely exceeded the proportion in which nature unaided has effected cures under similar apparently desperate circumstances. Besides the above plans of management, particular articles of the Materia Medica have acquired a more or less diffusive credit with the profession or the public. Among these may be mentioned, *chloroform*, used by inhalation, *Persian naphtha*, *wood naphtha* or *pyroxylic spirit*, *terchloride of carbon*, *solution of chlorine*, *tincture of camphor*, *charcoal*, *sulphate of quinia* in very large doses, *strychnia*, *gallic acid*, and *galvanism*. But, as before observed, experience has not pronounced so favourably in relation to any of these remedial means, as to obviate the necessity of a recourse to general principles. The author has already given his views as to the course of treatment which these principles appear to him to suggest; and his own experience, so far as it has gone, is in its favour.

Article III.

CHOLERA INFANTUM.

Syn.—Summer Complaint of Children.

This affection, though not unknown in Europe, is comparatively so rare as to have escaped the special notice of most of the writers of that continent; and, when it occurs, is merely ranked among the cases of gastro-enteric irritation or inflammation to which infancy is subject. Its frequency and great fatality in this country make it an object of strong interest; and both among the profession and the people at large, it is universally considered as meriting a distinct designation.

The complaint usually affects children between the ages of three months and two years, though instances sometimes occur before the first, and after the last of these two periods. It is exclusively a disease of the warm season, commencing with the first heats of summer, and ceasing upon the occurrence of cool weather in autumn. It is confined, moreover, almost entirely to cities, and prevails most in those of largest size, and most densely peopled.

Symptoms.—The attack of cholera is often preceded, for a longer or shorter time, by diarrhœa; but sometimes the vomiting and purging commence simultaneously. In fatal cases, of short duration, the vomiting usually continues to the end; but, when the disease terminates favourably, or is much protracted, it very often subsides considerably, or ceases altogether, leaving only the diarrhœa behind. Occasionally the disease is exceedingly violent and rapid; the vomiting and purging are almost incessant; the stomach rejects everything swallowed, even cold water; the intervals are marked by great languor and distress, with more or less spasmodic pain of the stomach and bowels; and, if relief is not afforded, prostration comes on, with a cool and clammy skin, pallid and shrunken features, half-closed eyes, insensibility amounting at length to coma, and death in three or four days, or sometimes even within twenty-four hours.

Much more frequently, however, the attack is attended with febrile symptoms, and the case protracted to one, two, or three weeks, or more. In such instances, the pulse is frequent, small, and weak or corded, the mouth is hot, the tongue somewhat furred, and the surface of the body irregularly heated; the head and trunk being often above the healthy standard of temperature, while the extremities are cool. Writers in general describe the fever as remittent, and state that the exacerbation occurs in the evening. It is sometimes attended with delirium or stupor.

The abdomen, though usually flat or sunken, is sometimes swollen and painful on pressure. In fatal cases, the vomiting occasionally continues unabated to the close, with the symptoms already mentioned; but more frequently it diminishes or ceases, leaving a diarrhœa, which runs on for several weeks, and gradually wears out the patient. In the progress of the complaint, the child emaciates rapidly; the flesh becomes soft and flabby; the skin hangs loosely about the neck; the features shrink greatly; the eyes are sunken; and the whole surface becomes pale, and either cool and clammy, or harsh and dry. In the more advanced stages, various morbid phenomena are presented. The abdomen is tumid or much sunken; the mouth is moist and aphthous, or brownish-red and dry; petechiæ occasionally appear upon the surface of the body, and a small vesicular eruption on the breast; the skin sometimes assumes a dull dirty hue, and the conjunctiva appears blood-shot; the emaciation is extreme; the circulation is in the lowest state of languor; the child is often exceedingly restless, rolling the head from side to side and tossing the body in various directions, with moans and plaintive cries; at length coma sets in, and the scene is closed not unfrequently with convulsions, or apparently hydrocephalic symptoms.

Throughout the complaint, the child generally sleeps with the eyes more or less open; there is almost always thirst, which is sometimes insatiable; the appetite is variable and capricious, sometimes wanting, sometimes rapacious, and again seeking the most unusual articles of food. The discharges are in a high degree various in character. At first, they consist of the previous contents of the stomach and bowels; and the matter vomited is always liable to be modified by substances swallowed, being frequently mingled with milk, either liquid or in various states of coagulation. The discharge of curdled milk is popularly viewed as an unfavourable sign, but is in fact the reverse, as it indicates the continued possession of a degree of digestive power by the stomach. After the discharge of the ingesta and feculent matter, the evacuations are for the most part thin and copious, sometimes colourless, but usually more or less tinged green, yellow, or brown, and not unfrequently deep-green. Along with the more liquid parts, the stools often contain concrete or semi-concrete matter, yellow, green, white, or translucent, or of these different characters variously combined, and not unfrequently tinged with blood. Sometimes they consist chiefly of slime. At an advanced period, they are often copious, and dark-coloured or reddish, like the washings of putrefying flesh. Throughout the complaint, they are either inodorous, or sour, putrid, or otherwise offensive, but seldom if ever have the healthy fecal smell. When the disease has degenerated into a lingering diarrhœa, it very commonly happens that more or less appetite remains, without the power of digestion; and the ingesta pass from the bowels little if at all changed. Worms either dead or alive are not unfrequently discharged by stool, or even from the stomach. Dr. Dewees considered the passage of live worms as a very unfavourable sign.

The duration of the disease varies from a few hours to weeks, or even months. When terminating in a diarrhœa, it often runs on for a long time, sometimes improving under treatment, or with the diminished temperature of the air, and then again relapsing when the favourable circumstances change, until at length the system is worn out, or the permanent return of cool weather turns the scale in favour of health. The struggle is often one of time; the aim of the physician being to keep the enemy at bay, until he can receive the aid of the advancing autumnal season. There is scarcely any condition of the disease so desperate as to forbid all hope; recoveries having occasionally taken place under the most unpromising circumstances. Perhaps the most alarming symptoms are those of hydrocephalus occurring in the advanced stages. A general subsidence of the morbid phenomena affords, of course, ground for a favourable prognosis; but one of the most cheering signs is a return of the discharges to the healthy condition. Increased liveliness on the part of the child, a regular appetite, and diminished frequency of the evacuations, are also very favourable signs.

Anatomical Characters.—According to Dr. Condie, if death take place early, an unusual paleness of the mucous coat, and more or less hepatic congestion, are often the only morbid appearances discoverable. (*Diseases of Children*, p. 219.) Dr. Hallowell states that there is "undue developement of the follicles, both of the stomach and intestines, or of one of those organs, without inflammation of the mucous membrane." (*Am. Journ. of Med. Sci.*, N. S., xiv. 42.) At a more advanced stage, there is generally some indication of inflammation; the mucous membrane of the stomach and bowels exhibiting more or less redness in points and patches, and an increased developement of the glandular follicles. Dr. W. E. Horner found the mucous follicles in great numbers enlarged, and even ulcerated, both in the small and large intestines; and in one case he observed small ulcerations of the surface of the membrane in the jejunum. (*Am. Journ. of Med. Sci.*, iii. 253.) The large intestine was in some degree inflamed and softened in almost all the cases examined by Dr. Hallowell. The gastric mucous membrane is sometimes very soft, so as to be readily scraped off by the nail. Livid or purple spots have been observed upon the exterior surface of the stomach and duodenum. The bowels usually contain green, yellowish, or colourless mucus. Dr. Horner noticed pus in considerable quantities in the colon in one case; and retained feculent matter is sometimes found in the large intestines. The liver is usually enlarged and congested; and the gall-bladder contains a liquid, which is sometimes dark-green, and sometimes pale or nearly colourless. The brain has also been occasionally found congested; and serous effusion in the ventricles or upon the surface, and thickening and opacity of the arachnoid have been observed. In cases which have exhibited hydrocephalic symptoms before death, the brain is either generally or partially softened. Dr. Lindsly found the bladder, in several cases, quite empty and much contracted. (*Am. Journ. of Med. Sci.*, xxiv. 306.)

Causes.—The main cause of cholera infantum is undoubtedly a combination of heat of weather and the impure air of cities. Neither of these causes is alone sufficient; for the disease does not occur at an equal or even greater elevation of temperature in country places; nor in cities during cold weather. The peculiar condition of the air generated in a crowded population appears to be essential; as even miasmatic districts in the country are exempt. It is true that miasmata have been supposed to favour the disease; but this is contrary to the personal observation of the author; and it is a well known fact, that our autumnal fevers, which are universally believed to be of miasmatic origin, scarcely ever penetrate the densely built portions of our cities, where cholera infantum is most rife. It is a fact of constant observation, that this disease is most frequent and most virulent in crowded lanes, courts, and alleys, where population is thickest, and ventilation most imperfect. It is, indeed, one of the greatest scourges of our large cities. According to Dr. Condie, 3576 children died of it in Philadelphia during a period of 20 years; and Dr. Lindsly states that, of 201 deaths in Washington, during the three summer and first two autumnal months of the year 1838, fifty-five, or about one quarter, were of cholera infantum.

But there are other causes which produce a predisposition to the disease, or call an already existing predisposition into action. Among these may be mentioned the process of dentition, unwholesome food, worms, and exposure to cold in a relaxed state of the skin. Dentition, though probably not alone capable of producing it, very much favours its production, and greatly aggravates the danger. Most of the fatal cases occur during this process, and few after its completion. Hence, children are universally considered as having passed the period of greatest danger, when the second summer is over. That diet has much influence upon the origin and severity of the complaint is proved by the fact, that children fed by the bottle, or the spoon, are more frequently and dangerously affected than those nourished at the breast.

Nature.—From the symptoms of the disease, and the appearances upon dissection, it may be safely inferred to consist essentially in an irritation or inflammation of the alimentary mucous membrane, directed especially to the mucous follicles, and associated with a congested and torpid state of the liver, probably depending upon the same cause. The morbid phenomena connected with other organs are probably secondary or accidental.

Treatment.—The first indication in the treatment of cholera infantum is obviously to remove the causes. While these continue to act, the most judicious efforts of the practitioner will for the most part be either quite nugatory, or but partially successful. The patient may be relieved, may even be apparently cured; but the disease will often return under less favourable circumstances of constitution, than at first; and, though a partial restoration may be again effected, and this alternation of relief and relapse may occur several times, yet there is great danger that the powers of vital resistance may be quite broken down, before the morbid cause shall cease with the hot season. The child, therefore, should be promptly removed into the pure air of the country. In general, the happiest change in the disease speedily follows this change of atmosphere. With a proper attention to diet and clothing, the child will almost always recover, even without medicine, or with such only as may be entrusted, by the medical adviser, to the judgment of the mother or nurse. The author has always been in the habit of pursuing this course, and, during the whole period of his practice, recollects only one fatal case, where the child has been sent into the country in the early stage of the disease. When the complaint is of longer standing, and the irritation of the bowels has had time to deepen into inflammation, the success of the measure is less striking, though even then it will be found the most effectual, especially when judicious medical advice can at the same time be obtained. Cases often occur, in which, under apparently the most desperate circumstances, the child, upon leaving the city, almost immediately begins to revive, and advances rapidly to convalescence. Should circumstances render a removal impracticable, the patient should be carried daily into the country, or into one of the open and most airy spots of the city, and kept there as long as possible; and great care should be taken to have the apartments at home well ventilated, and perfectly clean and dry.

It is also highly important to examine the mouth of the infant at once, and, if the gums are swollen and painful, to lance them freely. Should the inflammation of the gums be extensive, from the pressure of several teeth, it may be advantageous, in addition to the lancing, to apply a few leeches to the cheeks, and a pair of blisters behind the ears.

Under the same head may be considered the diet and dress of the patient; as errors in these respects are among the common exciting causes of the disease. The food of the infant should be the mother's milk, or, if she be diseased, that of a healthy wet nurse; and the child should not be weaned during the existence of the complaint. The best substitute for this diet is perfectly fresh cow's milk, diluted with water. The farinaceous liquids prepared from barley, rice, sago, tapioca, arrowroot, wheat bread, water-crackers, &c., may also be used; but care must be taken that these substances are entirely free from mustiness. When there is much fever, solution of gum arabic, infusion of benne leaves, or other mucilaginous fluid may be substituted. The caution should always be observed, whatever nutritive drink may be used, to give it in small quantities, so as not to irritate the stomach; and the disposition which the child often evinces, in consequence of its thirst, to suck freely should be restrained. To quiet the excessive thirst, very cold water, or cold solution of gum arabic, given frequently in small quantities, is preferable to more nutritious fluids. Pounded ice, confined in linen or gauze, so as to prevent it from being swallowed undissolved, will often be found useful. In the advanced stages of the disease, when the system is much enfeebled, it will be proper to allow a portion of animal food, such as weak chicken or mutton broth; and the child may be permitted to suck a piece of ham, dried salt beef, salt fish, &c., if these upon trial should be found grateful. It occasionally happens that the little sufferer exhibits a peculiar longing for some article of diet, which may not be thought suitable. Should this disposition be permanent, it should be attended to, as the voice of nature; and the desired article should be allowed, with such caution, however, at first, as to insure against serious evil. The *clothing* should be such as to preserve an equable temperature of the surface, without oppressing the child. Very thin flannel should generally be worn next the skin, and the feet and legs should be protected by light woollen stockings.

In relation to the medical treatment, the indications appear to be, to remove sources of irritation from the alimentary canal by laxatives and antacids; to promote the hepatic secretion, and thereby remove portal congestion, by calomel or some other mercurial; to divert excitement externally by diaphoretics, and by measures addressed to the surface; to relieve irritation by anodynes, and inflammation, when of a decided character, by direct depletion; to check excessive evacuations, in the advanced stages, by astringents; to modify the morbid state of the affected membrane by alteratives; and finally, to support the patient by suitable stimulants when greatly debilitated.

In the early stage, attention should be first directed to the means for allaying the excessive vomiting. For this purpose, rubefacients should be applied to the epigastrium, so as to excite a very decided irritation upon the surface. Mustard, diluted with an equal quantity of rye-meal, is perhaps the most effectual application; but bruised mint steeped in brandy, or cataplasms made of the different spices, such as powdered black pepper, ginger, cinnamon, cloves, &c., separate or mixed, may be employed. At the same time, very small and repeated draughts of fresh and cold carbonic acid water; or teaspoonful doses, repeated every quarter or half hour, of lime-water and fresh milk, mixed in equal proportions; or some one of the aromatic waters or infusions, such as mint-water, and fennelseed tea; or camphorated tincture of opium, in the dose of five or ten drops sufficiently diluted, may be given internally, one of them being preferred to another according to the particular circumstances of the case, as, for instance, the degree of vascular action, the presence or absence of acid, &c. Dr. Dewees recommends, for the same purpose, a teaspoonful of strong coffee without sugar or milk, every fifteen minutes, and an injection of a gill of warm water holding a teaspoonful of common salt in solution, which may be repeated when the vomiting is severe. The latter he considers as the most prompt and certain remedy that can be employed. (*Phys. and Med. Treat. of Children*, 4th ed., p. 420.) Dr. Condie speaks favourably of the oil of turpentine, and of a solution of camphor in sulphuric ether, and, when everything else has failed, generally succeeds with a solution of acetate of lead, in doses containing about one-sixth of a grain, repeated every hour or two. (*Diseases of Children*, p. 223.) When the vomiting is excessive, and other means fail in arresting it, an anodyne injection may be resorted to, containing from three to six drops of laudanum in a little thin starch. Indeed, opiate enemata will be found highly useful throughout the complaint, when the irritation of stomach is considerable, and no symptoms of cerebral disease exist. They may be repeated in suitable cases every day, and, if given at night, will be found very useful by enabling the child to rest. Care, however, must be taken not to employ too large a dose; a mistake often made in infantile cases.

When the stomach becomes retentive, medicines should be given to evacuate the bowels. Combinations of rhubarb and magnesia usually answer well. They may be given in powder; but the syrup of rhubarb, and the solution of carbonate of magnesia in carbonic acid water, are perhaps preferable. A teaspoonful of the syrup, with twice that quantity of the solution, may be given every two hours until they operate. The operation of the rhubarb may be known by its colour in the stools. The magnesia is peculiarly suitable, when a sour smell and green colour of the evacuations indicate acid in the bowels. Advantage will often arise from administering these medicines in some aromatic vehicle. When the discharges are small, mucous, and attended with pain, castor oil should be substituted. But probably, upon the whole, the most effective cathartic in these cases is calomel. In children two years old or upward, I have seen it act most happily in numerous cases, in doses of two grains repeated at intervals of two, four, or six hours, until evidences of its operation were presented in the passages. Employed in this way, it often puts an almost immediate end to the disease, if given early. Another mode of exhibiting calomel, which is much employed, and is adapted to any age, is in doses of from one-sixteenth to one-quarter of a grain, repeated so that from one to two grains may be given in the course of twenty-four hours. This plan is peculiarly useful when the stomach is irritable, and the secretion of bile suppressed or greatly deficient. The calomel may be administered mixed with a little powdered gum arabic, in syrup or on the surface of a teaspoonful of milk, or simply introduced into the mouth of the infant with a little sugar. A good plan is to give the mercurial one day, and the syrup of rhubarb or other laxative on the next, and thus alternate them until the stools become bilious; or the two may be alternated upon the same day, or even given conjointly, at the discretion of the practitioner. The laxative plan should be continued until the discharges assume a more natural appearance, unless there may be reason to think that it aggravates the complaint, or that no benefit accrues from it. Occasionally, from half a drop to a drop or two of laudanum may be usefully added to the laxative. It quiets pain, and relieves spasm of the bowels, without preventing the cathartic action. It may thus be combined with syrup of rhubarb or castor oil. This latter cathartic, given in the form of oleaginous mixture, made with gum arabic, loaf sugar, mint or cinnamon water, and laudanum, may be used with peculiar advantage in the advanced stage, if the intestinal irritation approach the dysenteric form.

When the complaint has the character of diarrhœa from the beginning, or assumes that character in its progress, and there is little or no irritability of stomach, but still deficiency of biliary secretion, the minute doses of calomel may be very happily associated with the powder of opium and ipecacuanha, which quiets irritation of bowels, and gives a direction to the skin. Under these circumstances, also, the cretaceous preparations should be substituted for magnesia, especially if fever is absent, and the debility considerable. They are, like it, antacid, but rather astringent than purgative; and the indication is less to promote than to check the alvine evacuations. The mercurial pill, or mercury with chalk, may be substituted for calomel. These remedies may often be advantageously given in combination, as in the formula below.* If ipecacuanha should be objectionable, laudanum may be substituted for the Dover's powder in equivalent proportion. Mixtures made in the same way with carbonate of soda, or carbonate of potassa, as an antacid, are also occasionally used, but are less efficient. Cinnamon water may be substituted for that of peppermint; but, if the officinal preparation be used, it should be diluted with from two to four parts of water. This plan should be continued until the stools assume a healthy colour.

In a still more advanced stage, when the continuance of the evacuations threatens to exhaust the patient, it becomes necessary to attempt to arrest them by astringents. For this purpose, kino, catechu, or extract of krameria may be added to the cretaceous mixture above directed, from which the mercurial may be omitted, if no longer requisite. The decoction of logwood, or of cranes-bill (*geranium*, U. S. Ph.) may also be used; and, if a combined tonic and astringent effect is desired, that of the blackberry root or dewberry root. Some of the mineral astringents are perhaps still more efficient, especially acetate of lead, which has been highly recommended, and is certainly very useful in many cases of the diarrhœa following cholera infantum. Dr.

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* ℞.—Pil. Hydrarg. gr. vj; Pulv. Ipecac. et Opii gr. ij; Cretæ, vel Testæ Ppt. ʒi; Acaciæ pulv. ʒj; Sacchari ʒj; Aquæ Menth. P. f℥ij. S. A teaspoonful every two hours, or *pro re nata.*

Chapman, in his lectures, spoke favourably of alum. These remedies probably operate as much by an alterative impression on the mucous membrane, as by their astringency. They may in general be usefully combined with an opiate, and sometimes with ipecacuanha. Dr. Lindsly speaks, in strong terms, of the efficacy of a combination of acetate of lead and Dover's powder. The mineral acids sometimes prove useful as alteratives and tonics. These also should be combined with an opiate. The nitromuriatic acid is perhaps to be preferred. I have employed nitric acid, in the form of Hope's mixture (see *page* 602), with decided benefit. Nitrate of silver was employed by Dr. Skinner, of N. Carolina, in one almost desperate case, with the happiest result. The salts of iron may be resorted to in cases of obstinate diarrhœa connected with anæmia. Other substances sometimes used as alteratives are oil of turpentine, copaiba, and creasote. In great debility it may be necessary to resort to wine-whey and the ammoniacal preparations; and the vegetable tonics will often prove useful in hastening a protracted convalescence.

When, in the course of the complaint, there is much tenderness of the abdomen, and the patient is not greatly exhausted, leeches, followed by warm fomentations or emollient cataplasms, should be employed; and if these do not relieve the inflammation, they should be succeeded by a blister. In some rare cases, in which there is tension of pulse connected with gastric, intestinal, or cerebral inflammation, recourse may be had to the lancet. Should symptoms of meningeal inflammation occur early in the disease, they must be counteracted by local and general depletion, carried as far as circumstances will warrant, by cold applications to the head, and by blisters.

Throughout the complaint, remedies should be employed in reference to a direct impression upon the surface. In the early stages, the simple warm-bath, and, in the more advanced, the warm salt or mustard bath, may be tried, and if found beneficial may be repeated every day. Great advantage may be expected from the salt-bath, especially when the disease has terminated in diarrhœa. Baths of oak bark may also be tried under similar circumstances. When heat is deficient in the extremities, the equilibrium should be restored by frictions, and by rubefacients applied to the legs and arms. Oil of turpentine, liniment of ammonia, or warm tincture of Cayenne pepper, may be employed. Blisters to the extremities, under these circumstances, are also clearly indicated. Rubefacient applications to the abdomen should be occasionally used, and the effects of a flannel bandage in the advanced stages have been much praised.

Prophylactic measures should always be resorted to in cases in which a predisposition to this disease exists. The rules already given in relation to country air, ventilation, dentition, diet, dress, and exposure to sudden changes of temperature, are applicable here. The late Dr. Joseph Parrish used strongly to urge the propriety, when the predisposition is very strong, of fortifying the stomach and bowels by a digestible animal diet, and the use of aromatics, particularly the infusion of ginger, during the period of danger.

Article IV.

FLATULENCE.

Syn.—Eructation.—Crepitus.—Borborygmus.—Tympanites.—Meteorism.

Gases of different kinds are always found in the stomach and bowels, where their presence appears to be a provision of nature to sustain an equable distension of the abdominal cavity, under the constantly varying quantity of its liquid and solid contents. It is only when they are produced so abundantly, or accumulate so much as to become a source of decided inconvenience, that they can be considered in the light of morbid phenomena. In most instances, flatulence is a mere result of other morbid affections, and is to be regarded rather as a symptom than as a disease. But it is sometimes an original affection, without any appreciable organic or functional derangement, other than that which its existence necessarily implies, and, like dropsy, deserves to rank as a distinct disorder.

Symptoms, Course, Diagnosis, &c.—The symptoms of flatulence are such as depend either upon a too copious evolution of gas in the alimentary passages, or upon its undue detention in these passages, or upon these two conditions united. A sense of distension, or of other uneasiness is experienced in the stomach or some portion of the bowels, which is soon followed by the expulsion of air either upward through the mouth, producing *belching* or *eructation*, or downward through the anus, not unfrequently with a loud report, which, however, the patient has it generally in his power to suppress. These discharges are often brought about by the voluntary contraction of the abdominal muscles and diaphragm; but sometimes they are quite involuntary, and depend solely on the contraction of the muscular coat of the alimentary canal, or the elastic force of the confined gases. They are sometimes exceedingly copious, the air rushing from the stomach or bowels, or from both together, in an almost continuous torrent, and constituting a very annoying affection, which has been called by some writers the *dry cholera*. Flatulence is often also attended with a disagreeable rumbling or gurgling sound in the bowels, called *borborygmus*, which is produced by the passage of the air from one part to another, and its intermixture with the intestinal fluids as it passes. Besides the sensation of distension or pressure, provoking and relieved by the discharges, the patient is often affected with pains, which are in some cases moderate and fugitive, in others distressing and almost constant, and in others again severe and spasmodic, amounting even to the most violent colic. Occasionally also acute pain is felt in various other parts, sympathetically connected with the stomach and bowels. Thus, it is not very uncommon for the spasmodic pain of gastric flatulence to shoot upward into the breast and throat, and even to ascend to the head.

Meteorism, or *tympanites* is another distressing affection connected with flatulence. This consists in a distension of the bowels so considerable as to become visible. Perhaps the term *meteorism* may be appropriately applied to the slighter degrees of distension, and *tympanites* to that condition in which the abdomen is very much swollen, so as to be quite tense and sonorous. Sometimes the swelling is local, so as even to have given rise to the suspicion of the existence of solid tumours; sometimes it is equable over the abdomen. In its higher grades it is often very injurious. The muscular coat of the bowels, when greatly distended, loses its power of contraction; and thus, not only is the collection of gas allowed to go on increasing, but the passage of the liquid and solid contents of the canal is impeded, and obstinate constipation results. Sometimes, however, diarrhœa attends tympanites. Another injurious result is the derangement of function in the neighbouring parts, pressed upon by the expanded bowels. The respiration especially suffers in this way, in consequence of the upward pressure of the diaphragm. A case is recorded by Dr. Ashmead, of Philadelphia, in which death resulted from a cessation of respiration, consequent upon an enormous tympanitic distension of the bowels. (*Transact. of Col. of Phys. of Philad.*, Jan. 4, 1842.) Another fatal accident, sometimes proceeding from the same cause, is the rupture of the stomach or intestines by the expansive force of the confined air. In some rare cases of tympanites, the air is accumulated in the cavity of the peritoneal sac, instead of in the alimentary canal.

There is nothing determinate in the course of flatulence. It may come on suddenly and as suddenly disappear, or it may continue, with various fluctuations, for a great length of time. In the form of meteorism, or tympanites, it often lasts for years with little abatement or alteration. In some cases, it disappears spontaneously, in consequence apparently of the absorption of the gas; in others, it yields with greater or less facility to remedial measures; and, in others, again, it obstinately resists all the means employed, and ceases only with life.

The part of the alimentary canal in which the evolution of gas takes place, may sometimes be inferred from the point whence the ascending or descending current of flatulence seems to the patient to proceed, from the period intervening between the introduction of some flatulent substance into the stomach and the first appearance of the symptoms, and, in the case of meteorism or tympanites, from the particular position of the tumefaction. Flatulent distensions of the abdomen may be distinguished from liquid accumulations by the absence of the feeling of fluctuation produced by the latter, when the palm of the hand is placed on one side of the abdomen, and a gentle blow given to the other; from solid tumours, by the flat sound emitted by these upon percussion, instead of the clear resonance characteristic of confined air. It is not always possible to determine, whether the gas occupies the bowels or the peritoneal cavity. The former position, however, may be inferred, when the distension was, in its forming stage, or continues to be unequal, and when a gurgling sound on auscultation indicates a mixture of liquid and air.

The air evolved or confined, in flatulence is generally a mixture of different gases, among which oxygen, nitrogen, and carbonic acid are the chief. Not unfrequently inflammable air escapes, consisting probably of hydrogen, or its gaseous compounds. Sometimes the flatulent discharges are without odour and perfectly bland, sometimes they are loaded with offensive exhalations from the alvine contents, and sometimes they are acrid and burning. Little, however, is precisely known upon this subject.

Causes.—Flatulence has its origin either in the character of the ingesta, or the condition of the alimentary canal, or in the two sources combined. Food not digested, or but imperfectly digested in the stomach, is liable to a chemical decomposition, resulting in the evolution of gaseous fluids; and the quantity thus evolved from a very small portion of solid or liquid matter is sometimes enormous. This result may take place in a perfectly healthy condition of the digestive organs, if food be employed of a nature not adapted to the modes of living, or peculiar constitution of the individual, and consequently to his strength of digestion. Certain kinds of food and drink are peculiarly apt to evolve gases in the primæ viæ, and, on this account, are called flatulent. Such are cabbage, unripe fruits, melons, tough or fibrous roots, and fermenting or fermentable liquids. These will often evolve gas copiously in a healthy stomach. But, when the powers of digestion are morbidly enfeebled, the effect takes place in a much greater degree, and substances become flatulent, which, under ordinary circumstances, are easily dissolved in the gastric liquor. Any cause, therefore, which is capable of debilitating digestion, may act as a cause of flatulence. (See *Dyspepsia.*) The ordinary contents of the healthy bowels, consisting of the residuary alimentary matter and various secretions, are also liable to chemical reactions, which extricate gases, especially when they are confined too long in the intestines; and constipation thus becomes a cause of the disorder. When these secretions are unhealthy, in consequence of disease of the secreting organs, they are often highly flatulent. It is, moreover, probable that the chemical changes, which take place when the heterogeneous contents of the small intestines are converted into chyle, are often attended with the production of aëriform substances, even when the processes of digestion and of secretion are perfectly healthy.

There is reason to believe that a direct exhalation of gas often takes place from the mucous membrane. We know that such an exhalation occurs into the cellular tissue, constituting emphysema, and into the various closed serous cavities; and the alternation which has sometimes been observed between emphysema and flatulence of the bowels, leads to the inference, that the latter may be produced in the same manner. (*Dict. de Méd.*, xxi. 132.) The occasional sudden substitution of tympanites for diarrhœa is another evidence of a similar character. But positive proof of the fact is not wanting. Portions of intestine entirely emptied of their contents, and inclosed between two ligatures, have been observed to become distended with gas, especially when inflamed by some stimulant application. (See *Am. Journ. of Med. Sci.*, N. S., iv. 403.) What is the particular pathological condition of the mucous membrane which leads to this result is not known. It seems to be in some measure connected with defective or deranged innervation; for flatulent accumulations in the stomach and bowels, not attributable to any other known cause, are frequent in nervous affections, such as hysteria, hypochondriasis, and strong mental emotion. Some have supposed the globus hystericus to be a sudden distension of portions of the œsophagus by air, confined by spasmodic constrictions above and below it. Cold drinks taken too freely, during a heated state of the body, sometimes produce sudden attacks of flatulence, originating probably in exhalation or secretion. Another cause of flatulence is the habit which some acquire of swallowing air, and which may become a morbid condition, analogous to certain mental perversions ranked under hypochondriasis or monomania.

The form of flatulence denominated meteorism or tympanites, is produced by some cause preventing the discharge of the air contained in the bowels. This cause, whatever it may be, is itself sufficient to occasion the affection, without any unhealthy production or evolution of gas; for the air taken in with the food, and that which, as before stated, is always extricated to some extent in perfect health, must become morbidly accumulated, if any accidental excess of it be prevented from finding an exit. The effect, however, is much greater, when the causes of production or evolution, above enumerated, cooperate with those of detention. Among the latter are debility or atony of the muscular coat, impairing its contractile power; rigidity of the sphincter muscles of the œsophagus, pylorus, and rectum; spasmodic closures of the intestinal tube at other points; fecal accumulations; and mechanical obstructions of all kinds, as by tumours, permanent strictures, and foreign bodies. Tympanites is most commonly an attendant upon other diseases, especially enteric or typhoid fever, peritonitis, malignant dysentery, and the different forms of colic and obstruction of the bowels. In its chronic forms, it is often associated with hypochondriacal, hysterical, and uterine disorder. When dependent upon accumulation of air in the peritoneal cavity, it usually proceeds from perforation of the stomach or bowels, perforation of the diaphragm (*Arch. Gén.*, 4e sér., i. 471), or decomposition of the peritoneal membrane. It may, however, in this, as in other serous cavities, and in the cellular tissue, be the result of a secretory or exhaling process.

Flatulence is most common in infants and young children.

Treatment.—The indications are to cause the removal of the air already accumulated, and to prevent its evolution and accumulation in future. The first indication often requires prompt and energetic treatment, in consequence of the sufferings of the patient. The object may frequently be effected by the use of stimulants calculated to act directly on the alimentary mucous membrane, and thus indirectly to excite the muscular movement. Such are the medicines denominated carminatives. To this set belong most of the aromatics. These may be variously employed, in substance, hot infusion, or tincture; or the volatile oil of the aromatic may be substituted for the medicine; and they may be given separately, or differently combined, to suit the taste of the patient, or the views of the practitioner. Among those most employed are peppermint and spearmint, fennelseed, cardamom, caraway, cinnamon, cloves, allspice, black pepper, ginger, and calamus. Twenty drops of the tincture of oil of peppermint, or oil of spearmint (*essence of peppermint* or *spearmint*), dropped on sugar, will often afford prompt relief. Compound spirit of lavender, and compound tincture of cardamom, are agreeable preparations, and may be given in the dose of a fluidrachm. Hot ginger tea will be found especially useful when there are colicky pains. Fennelseed tea, given both by the mouth and by injection, is well adapted to infants. Recourse may also be had to various stimulants, which do not belong to the aromatics. The oil of turpentine is a powerful carminative. Cayenne pepper, oil of juniper, assafetida, camphor, ammonia, and ethereal oil, may also be occasionally used with advantage. Aromatic spirit of ammonia is an excellent preparation, when there is a depressed condition of the system. Assafetida and compound spirit of sulphuric ether (Hoffmann's anodyne) are peculiarly useful when flatulence is complicated with hysteric or other nervous disorder. Prompt relief is often procured, when severe stomachic pain depends on flatulence, from a fluidrachm of camphorated tincture of opium. When the bowels are affected with flatulence, the aromatics may often be advantageously combined with mild cathartics. The free use of lime-water does good in some cases, probably, in part at least, by combining with and neutralizing carbonic acid. Friction over the abdomen, agitation of the bowels by the hand with the body in a bent position so as to relax the abdominal muscles, jumping, jolting in a rough vehicle, or a ride on horseback, will aid much in the expulsion of the confined air. Compression by a flannel roller or otherwise, stimulating embrocations, and galvanism, have also been recommended. In *meteorism* or *tympanites*, injections of oil of turpentine or assafetida should be given, in connexion with other means; and, if the symptoms are severe, attempts should be made to draw off the air by the introduction of a long gum-elastic tube, through the rectum, far into the colon. Life has probably been saved in that way. When the danger is very imminent from the vast distension of the abdomen, and relief cannot be obtained by the ordinary measures, it may become a question, whether it would not be the duty of the practitioner to puncture the cæcum, or other part of the intestinal tube. In cases of excessive tympanites with irremovable obstruction of the bowels, the operation has been occasionally performed, with the effect of affording relief; though the cases afterwards terminated fatally, in consequence of the obstructing disease. (See *Am. Journ. of Med. Sci.*, N. S., xxiv. 543.)

To prevent the morbid collection or evolution of air, it is necessary to remove or obviate the cause. Flatulent food and drink should be avoided, and the diet should be made to conform as nearly as possible to the digestive powers of the patient. Should, however, flatulent substances enter into the diet, their effects may be somewhat corrected by associating them with stimulating condiments, as Cayenne and black pepper and mustard. If the complaint originate in, or be associated with, debility of stomach and bowels, this should be corrected by tonic medicines, and other means indicated under the head of dyspepsia. Constipation should be obviated by a proper regulation of the diet, and if necessary by laxatives; but, in the choice of means for this purpose, care should be taken to shun those disposed to occasion flatulence. Among the most appropriate are bran bread, as an article of diet, and rhubarb or aloes as a cathartic. Magnesia may be employed in connexion with these, when acid exists in excess in the primæ viæ. Unhealthy secretions into the bowels should be corrected, and the blue pill will often be useful to this effect, by its alterative action on the liver.

When there is reason to believe that the gas proceeds from a secretory or exhaling act of the mucous membrane, tonics and astringents are indicated. An infusion of galls with fennelseed has seemed very useful in my hands, under these circumstances; and I have repeatedly known the affection to yield to the free use of sulphate of quinia. Strychnia or nux vomica has also been recommended. Dr. Graves strongly advocates the use of acetate of lead in tympanites; and Dr. Baddeley, of Chelmsford, has employed both this salt and sulphate of zinc, in conjunction with an opiate, with success in very bad cases. (*London Lancet*, Jan. 8, 1848, p. 44.) As flatulence is often dependent upon other diseases, care should be taken, in all instances, to discover its source, and apply remedies to this, instead of wasting time in a direct combat with the flatulence itself. Particular attention should be paid to nervous derangements, which frequently occasion or aggravate it.

Great advantage will often be derived from combining, in the same prescription, medicines calculated to meet different indications. Thus sulphate of quinia, as a tonic, may be united in mixture with assafetida and one of the aromatic volatile oils, as carminatives; and such a mixture is often highly useful in the cases of infants subject to flatulence.[*] Magnesia may be associated, in mixture, with the aromatic oils, camphor water, and a little laudanum when there is pain. Rhubarb or aloes may be given in pill, with quinia or a bitter extract, and with assafetida, black pepper, or a volatile oil. Such combinations may be multiplied indefinitely, and often with great advantage, by a practitioner who possesses an adequate knowledge of medicines, and the modes of preparing them.

Article V.

PERITONEAL INFLAMMATION, or PERITONITIS.

The protection which the peritoneum gives to the alimentary canal is, perhaps, its most important function; and its diseases may, therefore, be very appropriately associated with those of the digestive organs. Inflammation of the peritoneum is susceptible of division into several varieties; but may be most conveniently considered under the two heads of the acute and the chronic.

1. ACUTE PERITONITIS.

Symptoms, Course, &c.—A chill is sometimes the first symptom of peritonitis; but perhaps more frequently the disease begins with pain; and occasionally the occurrence of the two phenomena is simultaneous. The pain is sharp and very severe, and usually commences in the lower part of the abdomen, in the hypogastric or one of the iliac regions, whence it gradually extends over the whole cavity. Sometimes it is changeable, occurring now in one spot and then in another; and not unfrequently is attended with a sense of heat or burning. The abdomen is always tender to the touch. The slightest pressure by the hand occasions exquisite pain, and whatever gives rise to contraction of the abdominal muscles has the same effect. Hence, the patient suffers much from vomiting, the act of defecation, the discharge of urine, and straining of all kinds. A deep inspiration is often very painful. Movements of the body in or out of bed are also painful; and even the weight of the bedclothes is often insupportable. Hence, the patient usually lies motionless upon his back, with his knees drawn up, so as at once to relax the abdominal muscles, and take off the weight of the covering. Another object of the supine position appears to be, to obviate in some degree the pressure of the bowels upon the parietal peritoneum. But this posture is not so universal as might be inferred from the description of most medical writers. The author recollects that, in one of the worst cases of peritoneal inflammation he ever witnessed, the favourite position of the patient was upon his left side, with the knees so much drawn up as to be almost in contact with the abdomen. Most frequently the tenderness is general, but in some instances is greatest in particular spots, and in others is confined altogether to one spot; indicating, in the latter case, the local position of the inflammation. From near the commencement, there is generally a feeling of hardness, tension, and elasticity in the abdominal parietes; and very soon a tumefaction begins, which increases with the progress of the complaint, and towards the close assumes the character of tympanites. In some cases, however, there is little swelling; and in others, none at all; the abdomen being sometimes even drawn in by the constriction of the muscles. The swelling is for the most part uniform, but is sometimes irregular, giving to the hand the sensation of a tumour or tumours in the abdomen, which may be either permanent or changeable. Percussion evinces at first a resonance healthy, or greater than that of health; but, as the disease advances, the sound becomes dull, especially in the depending parts. After the complaint has lasted a short time, the abdomen frequently offers, under auscultation, a friction sound, like that observed in pleurisy, and like it arising from the rubbing together, during respiration, of the opposing surfaces of the serous membrane, roughened by the effused coagulable lymph.

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[*] ℞.—Quiniæ Sulphat. gr. ij; Assafœtidæ gr. iv; Acaciæ pulv., Sacchar., āā, ʒss; Aq. Cinnamom. f℥j. Misce. *S.* A teaspoonful for a child one year old, four times a day.

Besides the above phenomena, there are many others, either sympathetic, or depending on a direct propagation of the irritation to contiguous parts. Nausea and vomiting, thirst, constipation, and scanty or suppressed urine are very frequent symptoms. The vomiting is sometimes exceedingly distressing. The constipation is obstinate, in those cases in which the muscular coat of the bowels becomes involved in the inflammation; but it is not a constant symptom, and sometimes gives way to diarrhœa. The face is pale, contracted, and marked by an expression of deep distress and anxiety, characteristic of the disease. The respiration is short. The pulse is usually very frequent, from 110 to 130 or more in a minute, small, and tense; though, in some rare cases, it is full and but little accelerated. The tongue is usually moist, and covered with a whitish or yellowish fur; but sometimes it is red and dry, and sometimes nearly natural. The patient is very often wakeful. The chill with which the attack commences, or which follows the occurrence of pain, is usually succeeded by febrile heat of surface, which, however, soon subsides; and, during the greatest severity of the complaint, the skin is often but little warmer than in health.

The march of peritonitis is in general rapid. In fatal cases, death sometimes occurs within twenty-four hours, and generally in about a week; but occasionally the disease runs on for three or even four weeks. An aggravation of the pain, tenderness, and other symptoms marks its advance; but, when the fatal termination approaches, the pain often suddenly subsides, or ceases altogether; and this may be considered as one of the most unfavourable signs, when not attended with a marked amelioration of the disease in other respects. At this stage, the pulse is extremely frequent and feeble; the extremities are cold, and sometimes purplish or livid; the countenance is sunken and ghastly; the abdomen is either tympanitic, or soft and flaccid; a troublesome hiccough often occurs; and a green or blackish matter is thrown up from the stomach, rather by regurgitation than vomiting, and sometimes flows from the mouth of the patient without his consciousness. Occasionally the bowels give way, and a similar dark matter is discharged per anum. Coma, or convulsions, or both, sometimes precede the fatal issue.

A favourable termination is indicated by a gradual subsidence of the pain, tenderness, and tension of the abdomen, a cessation of the vomiting, a diminished frequency of pulse, and a less anxious expression of countenance. Occasionally a copious discharge from the skin, bowels, or kidneys, attends the solution of the disease. In some cases, the symptoms entirely disappear, and the recovery is perfect. In others, a greater or less degree of pain and tenderness in the abdomen and frequency of pulse continues long after the danger is over; and sometimes a hard tumour in some part of the cavity remains for a considerable time. Again, the acute may subside into the chronic form of the disease; and the result thus be long postponed, and quite uncertain. In a few cases, the pus poured out by the inflamed membrane, and confined within sacs formed by the organized coagulable lymph, makes its way by ulceration either into some one of the hollow viscera, as the stomach, intestines, or bladder, or to the surface of the body, and is discharged. In some of these cases, recovery takes place, especially when the pus has found an outlet through the skin.

Various modifications of peritonitis as above described occasionally take place, and require notice. Thus, it is sometimes entirely *local*, affecting some one portion of the peritoneum only; and this is apt to be the case when the disease proceeds from a local cause, such as mechanical violence, or the inflammation of an invested organ. In such cases, it frequently happens that, though the inflammation is not propagated to any great extent continuously, it affects the portion of membrane opposed to, and in contact with that inflamed. The inflammation is thus more likely to be confined to one spot, when a fixed than when a movable organ is affected. Any part of the abdomen, where there is peritoneum, may be the seat of the affection. It is scarcely necessary to say that, in these cases, all the symptoms, both local and constitutional, are less violent than in general peritonitis. The local character of the affection is marked by the limited extent of the pain and tenderness, though it must be confessed that, in some instances, it would be very difficult to establish a certain diagnosis. The symptoms are much modified by the position of the inflamed membrane, and by the organ which it may invest. Thus, when the inflammation occupies the peritoneal covering of the *liver*, it not unfrequently happens that the skin, eyes, and tongue, are more or less yellow, in consequence of an extension of irritation into the substance of the organ. Great epigastric pain and tenderness, with severe constitutional symptoms, mark the peritoneal inflammation of the *stomach*; obstinate constipation, with a lower seat of pain, that of the *bowels*; painful irritation with tenderness in the hypogastric region, and great pain in micturition, that of the *bladder*. The *omentum* may be separately inflamed, in which case the pain extends over the front of the abdomen, and effusion into the folds of the membrane may occasion circumscribed swellings, perceptible to the touch, and liable to be mistaken for enlarged spleen, or ovaries, or scirrhous tumours of different portions of the bowels. Andral mentions, as characteristic of *pelvic* peritonitis, pain above and behind the pubes, and extending backwards towards the loins, tenderness in the hypogastrium, slight fever, sweats, and the formation of tumours in the cavity, which press on the neighbouring organs, as the rectum, vagina, and bladder, materially interfering with their functions. Another frequent seat of partial peritonitis is the *right iliac region.* This, however, is almost always secondary, depending either upon the propagation of inflammation from the exterior cellular tissue, or from the cæcum or appendix, or upon the direct irritation of matters which have escaped from these portions of the alimentary canal by ulceration. It is marked by great tenderness and tumefaction over the head of the colon, and by obstinate constipation, and frequently terminates in an abscess, which makes its way to the surface, either anteriorly or in the lumbar region. Other instances of local peritonitis are those in which the inflammation depends upon strangulation of the bowel, whether from hernia, intussusceptio, or other cause. In these cases, the symptoms of inflammation are always preceded by those of obstruction in its earlier stages, and subsequently associated with those of the same affection in its advanced stages, such as almost insuperable constipation, and vomiting of stercoraceous matter. (See *Obstruction of the Bowels.*) Partial inflammation sometimes becomes general, and may thus prove very dangerous; but, when confined to its original seat, it generally yields to proper treatment, unless complicated with some other more serious affection. As in the general disease, it occasionally gives rise to collections of pus, which is retained by adhesions between opposite surfaces of the membrane, and makes its way by ulceration either to the surface of the body, or into some one of the hollow viscera, occasionally producing, in its passage, much destruction of the organs with which it may come in contact.

I have known sudden swelling of the scrotum, with great pain and tenderness, to come on in the course of peritonitis, consequent upon the extension of the inflammation to the tunica vaginalis of the cord, and that altogether independent of the existence of hernia.

Though for the most part an exceedingly painful disease, peritonitis sometimes comes on very insidiously, with little pain, and no great degree of tenderness, and runs its whole course, even to a fatal termination, without being suspected. This form of the disease is most apt to occur in persons of feeble health, and as a complication of other acute diseases, which serve to mask it. Affections of the brain, which diminish the ordinary sensibility, are perhaps most liable to this dangerous complication. In all these cases, when a sudden and unaccountable increase of disease takes place, with the peculiar countenance and pulse of peritonitis, even without abdominal pain, a close examination should be instituted; and, if tenderness is found to exist generally through the abdomen, or in some one part of it, the existence of this disease may be suspected. Severe rigors, followed by some febrile reaction, with nausea and vomiting, and distressing sensations of sinking at the epigastrium, which can be traced to no other cause, should lead to the suspicion of peritonitis. In all doubtful cases, the observation of the friction sound in auscultation would very much aid the diagnosis.

Peritonitis, like all other inflammations, is sometimes connected from the commencement with a typhoid state of system, marked by feebleness of the circulation, general prostration, a dry and dark tongue with sordes about the teeth, a tendency to hemorrhage from the mucous surfaces, and various nervous symptoms, as delirium, subsultus tendinum, coma, &c. Sometimes nervous symptoms attend it without evidences of typhoid disorder. Headache, active delirium, subsultus, convulsions, sudden alternations in the violence of the ordinary symptoms, restlessness, wakefulness, and great general distress, are among the characters of this form of the disease. Andral states that he has known the disease to recur regularly for some time with the paroxysms of an intermittent, disappearing entirely in the intervals, until at length it became permanently established and continuous. (*Clinique Médicale*, 3e ed., ii. 639.) Not unfrequently the symptoms alternately diminish and increase, in the manner of a remittent disease.

Another modification of peritonitis is that resulting from the *perforation of a hollow viscus* or cavity, and the escape of its contents into the peritoneal sac. The inflammation is in this case most frequently general, though it may also be local. It is usually preceded by symptoms of some other disease of longer or shorter duration. The commencement of the peritonitis is marked by the sudden occurrence of severe pain, without preceding chill, usually in some one point, from which it rapidly spreads over the abdomen. In a very short time, all the symptoms of the disease in its most violent form are developed, and death ensues generally in two or three days, and sometimes even in a few hours. This form of peritonitis is generally fatal. But occasionally, when the perforating orifice is small, and in a neighbourhood where the intestine is not movable, the inflammation is limited to a small extent, the effused matter becomes isolated through the agency of adhesion, and the affection ends in an abscess, which pursues the same course with those alluded to in preceding sections, and with the same result.*

Puerperal peritonitis is still another variety of this affection. It attacks women in child-bed, usually within three or four days after delivery, and sometimes within twenty-four hours. The pain sometimes comes on gradually and almost insensibly, sometimes suddenly and with severity, and in many cases is subject to exacerbations, resembling after-pains, with which it has often been confounded. It almost always commences in the hypogastric and lumbar regions, and, after the whole abdomen has become involved, is apt to be felt most severely in those parts. The tenderness on pressure is also at first confined to the region of the uterus. The lochia are diminished or suppressed; the mammæ become flaccid; and the secretion of milk either is not established, or is suspended if it had commenced. The abdomen is soft and flaccid at first, and, though it ultimately swells and becomes tympanitic, the parietes have none of that elastic tension, which is found in ordinary peritonitis, probably owing to their great distension in advanced pregnancy. The effused liquid is often copious, so that fluctuation in the abdomen is readily perceived. It is unnecessary to repeat an account of the general symptoms, which are essentially the same as those of ordinary peritonitis, though usually more severe. The pulse is more frequent, the respiration more hurried, the countenance more deeply affected, the prostration of strength greater, and the march of the disease more rapid and fatal. Severe pain in the head, vertigo, and delirium are more frequent, and cough is a common attendant of the puerperal affection. Death, which in the severe cases occurs in the course of a few days, and sometimes in less than twenty-four hours, is preceded by symptoms of great prostration; an extremely rapid and feeble pulse, cold skin, a brown and dry tongue, sordes about the teeth, tympanitic abdomen, and discharges of black or dark-green matter by vomiting and stool. There is reason to believe that puerperal peritonitis is sometimes a secondary affection, in the same manner as erysipelas, being dependent upon or at least associated with a malignant febrile state of system, of which one of the characters is a depraved condition of the blood. In such cases, the general actions are feeble almost from the commencement, and the state of system is similar to that which occurs in malignant typhus. This form of the disease, the only one to which the name of puerperal fever can be attached with propriety, is most apt to result from epidemic influence.

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* It is sometimes impossible to decide with certainty, before an external communication has been effected, as to the existence of perforation of the bowel, in those cases in which, adhesion having taken place between the intestinal and parietal peritoneum, the alvine matter seeks an outlet by means of ulceration. The following sketch of a case which occurred to me, in the Pennsylvania Hospital, in the autumn of 1847, may prove useful, by putting the young practitioner upon the proper track in similar cases. The patient, who was a man short of the middle age, complained at first of pain in the left lumbar region, which had been treated as rheumatism before I saw him. I found him with fever, diarrhœa, tympanites, and a dry tongue; and should have been disposed to consider the case as one of enteric or typhoid fever, but for the absence of the rose-coloured eruption, and of the characteristic countenance of that affection. At length a tumour was perceived in the back, which gradually increased, and, after a considerable time, presented an obscure fluctuation, with a diffused erysipelatous redness, and swelling of the subcutaneous areolar tissue for a great extent. Thinking that it might, possibly, have some connexion with the bowel, I directed it to be opened. An offensive sanious fluid escaped, with a decided feculent odour. But extensive gangrene of the cellular tissue came on, under which the patient sank. Examination after death disclosed the existence of an ulcer of the colon, near the sigmoid flexure, communicating with the exterior abscess. Except at this one spot, the colon appeared healthy; but there was inflammation of the mucous membrane of the ileum for the extent of more than a foot from the ileo-cæcal valve, though without ulceration, and without special disease of the glands of Peyer. With the light which dissection thus afforded, I should, in a similar case, be disposed to make an early and deep incision into the tumour, in the hope that the intestinal contents might thus find an easy escape, and the patient be spared the gangrenous destruction of the cellular tissue, which was the probable cause of death in this instance.—(*Note to the second edition.*)

Peritonitis is always a dangerous disease; but, when it occurs in a person of good constitution, and without complication, generally yields to early and efficient treatment. That form of it which depends on perforation is the most fatal. Next, perhaps, in degree of danger is the puerperal peritonitis. The inflammation is least dangerous when it is partial, and, as a general rule, when it results from external injury.

Anatomical Characters.—These are such as inflamed serous surfaces generally present. (See *page* 56.) They will not, therefore, require a very particular notice in this place. If death has occurred very early, the membrane may offer no other morbid appearance than redness. In cases of longer duration, there is almost always more or less of a fibrinous exudation upon the surface of the membrane, and of free liquid in the cavity. At first it is often in the form of a thin, viscid, almost colourless layer; but it soon becomes more copious, and is then soft, of a dull-white, yellowish, or greenish-yellow colour, and generally more or less organized, forming false membrane, which connects together the opposite peritoneal surfaces, agglutinating the folds of the intestines, and causing the different viscera to adhere to one another, or to the sides of the cavity. This layer is, in advanced cases, several lines in thickness, and has an irregular surface, which gives rise to the friction sound observed in auscultation during life. The degree to which it is organized depends on the character of the inflammation, and the stage of the disease. In some cases, little tendency to organization is shown at any stage; in others, it appears to have commenced a few hours after exudation. The liquid is found in the interstices of the intestinal convolutions, and more largely in the pelvis and iliac fossæ. It is sometimes colourless and limpid, or whey-like, with fibrinous flakes floating in it; sometimes yellowish and turbid; sometimes milky, sero-purulent, or bloody; and sometimes composed of nearly pure pus, or of blood. In consequence of the adhesions formed by the false membrane, it is often contained in sacs, which appear like so many abscesses, and now and then occasion irregularities, observable upon the surface of the abdomen during life. In some instances, pus is formed without the peritoneum. Gangrene is very seldom observed in the membrane, except in cases in which the bowel has been strangulated. The dark spots occasionally noticed, resulting from effused blood in the submucous tissue, have probably been mistaken for mortification.

If the disease has depended upon the perforation of the alimentary canal, gas generally escapes upon the opening of the peritoneum, and is more or less fetid as the perforation has been lower down in the canal. The character of the liquid in the cavity varies with the organ perforated, and sometimes serves to designate the organ. Thus, portions of undigested or partially digested food have probably come from the stomach; a yellowish or brownish fetid liquid from the bowels; solid fecal matter from the colon; a yellowish-brown, or green inodorous liquid from the gall-bladder or biliary ducts; and liquid of a urinous smell from the bladder. Stones of fruit, calculi, and biliary concretions are sometimes found. By taking the upper portion of the bowel between the fingers, and compressing it steadily towards the lower extremity, the escape of gas or liquid will sometimes indicate the point of perforation, which might otherwise escape attention.

In the typhoid cases of peritonitis, especially the puerperal, little or no fibrinous exudation is found, the effusion consisting of a serous, milky, or bloody fluid, with only a few flakes of coagulable lymph here and there adhering to the membrane.

Though vomiting is so frequent a symptom of peritonitis, the mucous membrane of the stomach is only in exceptional cases found to have been the seat of any considerable inflammation.

Causes.—Peritonitis may arise from the ordinary causes of inflammation, such as vicissitudes of temperature, excessive use of stimulating food or drink, suppression of habitual discharges whether healthy or morbid, retrocession of cutaneous eruptions, and translation of gout or rheumatism. It is, however, more frequently the result of local violence, as of blows, falls, and bruises of all sorts, and of wounds penetrating the peritoneal cavity, including various surgical operations, among which may be mentioned that for strangulated hernia and for tapping, and the Cesarian section.

Sometimes it is secondary to other diseases, especially to inflammation of the organs which receive a complete or partial covering from the peritoneum. Inflammation of the womb, whether occurring from violence to that organ, or injury received in the process of parturition, is said frequently to extend to the peritoneal membrane. The disease is an ordinary result of strangulation of the bowel, both internal and external, when not relieved. A frequent cause of it is perforation of the different hollow viscera of the abdomen, or of morbid cavities, allowing the escape of their contents into the peritoneal sac. This perforation may be produced by ulceration, by mortification and the separation of sloughs, or by mechanical rupture depending upon an extraordinary distending force within the cavities, or weakening of their parietes. Thus, perforation of the stomach, bowels, gall-bladder, biliary ducts, urinary bladder, kidneys, and ureters; the opening of abscesses in the substance of the organs, or in the cellular tissue without the peritoneum; the discharge of tubercles; the rupture of distended cysts or of aneurisms, may all occasion peritonitis. The perforation of the alimentary canal is most frequent in the course of typhoid fever and of phthisis, in both of which affections ulceration of the mucous membrane of the bowels is not uncommon. It is also not unfrequently produced by foreign bodies lodged in some portion of the canal, especially in the cæcum and appendix, where they occasion inflammation, ulceration, and ultimately perforation of the coats of the bowel. Peritonitis sometimes comes on in the course of other diseases, particularly those of a febrile character, without any assignable cause, imitating, in this respect, the inflammation of various other parts or organs.

Of the variety of peritonitis denominated puerperal, the cause is probably in many instances a propagation of inflammation of the substance of the uterus, or of its veins or absorbents, to the peritoneal covering, or the direct participation of that covering in violence done to the organ. The disease may also arise from irregularities of diet, vicissitudes of the weather, &c., as any other inflammation. But very often also it arises from a peculiar epidemic influence, or, as some believe, from contagion; and thus originating, assumes not unfrequently its most malignant form. Of this character is the puerperal peritonitis of hospitals and lying-in establishments, which has often proved so fatal, and so little under the control of remedies. It has been asserted that peritonitis in the male has sometimes also occurred epidemically.

Diagnosis.—When the disease is well developed, and attended with the usual symptoms, without complication, there can be little difficulty in its diagnosis. From *colic* of all kinds it may be distinguished by the great tenderness upon pressure, the more persistent and less paroxysmal pain, and the almost constant supine position of the patient; from *mucous gastritis and enteritis* by the sharper pain and greater tenderness, the elastic tension of the abdomen, the supine position, the greater tendency to constipation, the small and very frequent pulse, the sunken and anxious countenance, and generally the deeper impression upon the constitution; from *inflammation of the muscular coat of the bowels*, by the more decided colicky symptoms of this affection in its earlier stages, its excessively obstinate constipation, and the fecal vomiting which attends its close; from *inflammation of the liver, bladder*, and other parts more or less invested by the peritoneum, by the absence, in these affections, of the symptoms which characterize peritonitis, while, if the membrane is inflamed, the acute pain, tenderness, abdominal tension, position, pain upon movement, &c., serve to indicate the fact; from *rheumatism of the abdominal muscles*, which bears to it the closest local resemblance, by the vomiting, the febrile symptoms, the peculiar expression of face, and the difference in the pain which attends motion in the two cases, the pain in rheumatism being much severer from voluntary movements, which call the muscles into contraction, than from passive movement, while both occasion severe suffering in peritonitis. The distinction between the inflammation of the peritoneal investment of an organ, and the substance of the organ itself, is often rendered difficult by the fact, that the functions of the organ are almost always more or less deranged, when the investing membrane only is inflamed; and, in fact, the two affections are often simultaneous; but, an accurate diagnosis is of less consequence, as the treatment required by the peritoneal inflammation would in general involve that required by the inflamed organ, and, when the symptoms are violent and the diagnosis doubtful, the measures required by the more dangerous affection should be adopted.

There is sometimes danger of confounding with peritonitis a *peculiar nervous affection of the contents of the abdomen and pelvis*, occurring especially in females. This is often attended with severe pain, tenderness, tumefaction, vomiting, and frequent pulse. But the pain is less constant; and, though aggravated by slight pressure, is sometimes alleviated when the pressure is strong. It is, moreover, often quite paroxysmal. The patient is liable to various nervous derangements of an hysterical character; and is able and disposed to change position in bed. The pulse and countenance are less disturbed; the urine, instead of being scanty, is usually copious and pellucid;

and not unfrequently pressure upon the spine, by the suffering it occasions, at once discloses the nature of the disorder. In all cases of abdominal disease, the friction sound under auscultation may be considered, when it occurs, as a certain sign of peritonitis; though it does not always attend this disease.

Treatment.—In ordinary peritonitis, prompt and copious bleeding is the most important remedy. The pulse cannot be relied on as a guide. The heart appears to be cramped in its action by the violence of the local affection; and the pulse, though often corded, is generally small and very frequent, and well calculated to mislead an inexperienced practitioner. Indeed, it often becomes more developed under the loss of blood, and this result may always be considered as a proof that the remedy was properly applied. Neither should paleness of face, and absence of febrile heat upon the surface, deter from venesection, when the evidences of inflammation are unequivocal, and the patient is seen early in the attack. The quantity of blood withdrawn must be regulated by the apparent constitution of the patient, the stage of the disease, and the effects produced by its loss. In a tolerably vigorous individual, soon after the attack, from fifteen to thirty fluidounces may generally be taken with propriety; and the bleeding may be repeated once and again, if the symptoms should remain unabated, and no decided evidences of exhaustion be observable, though the amount abstracted at the second and third operation should not generally be so great as at first. It may sometimes be necessary to repeat the bleeding within twenty-four, and even twelve hours. Faintness, or decided sinking of the pulse, occurring during the flow of blood, should be received as an evidence that sufficient had been taken for the time.

After the first bleeding, from five to fifteen grains of calomel should be given, followed in six or eight hours by castor oil, or sulphate of magnesia, or infusion of senna with salts, whichever may be most easily retained by the stomach, so as to produce a thorough evacuation of the bowels. The irritation of accumulated feces, and the injurious but vain efforts at movement in the muscular coat of the bowels which they tend to sustain, are thus avoided, and at the same time a wholesome revulsion effected towards the inner intestinal surface, and congestion of the portal system in some measure relieved by secretion from the liver and mucous membrane. Calomel is peculiarly appropriate, because better retained than most other cathartics, and for the reason, moreover, that it serves as an early basis for mercurial treatment, should this be ultimately advisable. But, after the first thorough evacuation of the bowels, it is not desirable to push purgative medicines actively. I am convinced that any benefit they might produce would, as a general rule, be more than counteracted by the disadvantage of the continued friction of the inflamed serous surface of the intestinal convolutions. It is considered of the utmost importance to keep the opposite surfaces of an inflamed synovial membrane at rest. Why not also those of the inflamed peritoneum? It is true that this objection is of less force when the inflammation is confined to the abdominal parietes, or to the investment of an immovable viscus; and, in such cases, when the diagnosis can be clearly made out, it may be proper to keep up an active purgation. In general, however, it will be quite sufficient to procure one or at most two soft evacuations daily, by the use of the mildest laxatives, aided by enemata. In the selection of the laxative, regard should be had to the irritable state of the stomach. Small doses of the effervescing Seidlitz powder, or of Rochelle or Epsom salt dissolved in carbonic acid water, or of infusion of tamarinds with cream of tartar, may be employed early in the day, and rendered effective by a laxative enema in the evening. These often allay vomiting, and also act usefully as refrigerants. Castor oil may sometimes be given in very small quantities, when acceptable to the stomach; and some authors speak highly of a combination of this with oil of turpentine. Should these laxatives prove irritating to the stomach, they should be suspended, and reliance placed upon enemata alone.

After one or two large bleedings, and a full evacuation of the bowels, recourse should be had immediately to leeches, which should be very freely applied, especially over those points of the abdomen where the pain and tenderness are greatest. From fifty to one hundred and fifty American leeches should be applied at once; and the application may be subsequently repeated, if required by a persistence of the symptoms. The leeches should be followed by warm fomentations, or, what is better, if the patient can support their weight, by light emollient cataplasms, as of mush, oatmeal, flaxseed-meal, &c., large enough to cover the whole surface of the abdomen. These cataplasms should be kept on steadily for several days. Laudanum may sometimes be advantageously added to them. Instead of warm emollient applications, some recommend cold water, or even ice to the abdomen; but I have not tried this remedy, and confess that I am afraid of it.

Opium may be used very early in this inflammation. After free bleeding and leeching, and the full evacuation of the bowels, there is no occasion for further delay. At first, the best plan is to give the narcotic at night, so as to secure rest to the patient, and quiet to the inflamed membrane. Calomel should generally be added to it in small quantities. This is useful by preparing for the easier evacuation of the bowels on the following day, but still further, by facilitating the mercurial impression, should this be afterwards determined on. One or two grains of opium, with from two to four grains of calomel, may be given in one dose; or two grains of the narcotic and four of the mercurial may be made into four pills, two of which may be administered at once, and one every hour or two afterwards until the patient feels the anodyne influence. A direction to the surface of the body may be very usefully given by the addition of a grain or two of ipecacuanha to the mixture, should it not prove offensive to the stomach.

In the same stage, advantage will often be found from the use of the effervescing draught, every two hours through the day. It acts favourably by quieting the stomach, and producing diaphoresis; two effects which are strongly indicated. Other anti-emetics that may be employed are small draughts of cold carbonic acid water, and creasote when there is no reason to suspect mucous gastritis. If the vomiting should be obstinate, it may sometimes be relieved by copious draughts of warm chamomile tea, or simply warm water, or, if necessary, a small dose of ipecacuanha, which serve to wash out the stomach, and to remove any offending matter that may be present in it. Anodyne enemata may also be resorted to. In order to favour diaphoresis, the warm bath may sometimes be used with advantage, especially in the cases of children; but in adults, on account of the difficulty and pain of motion, it would be better dispensed with, unless means are at command to apply the remedy, without disturbing the relative position of the different parts of the body.

As the disease advances, the fomentations or cataplasms may be superseded by rubefacient applications, especially hot oil of turpentine, or by blisters, which, in general peritonitis, should be made sufficiently large to cover nearly the whole anterior surface of the abdomen.

Should the complaint not exhibit evident signs of yielding in the course of three or four days, recourse should be had to the mercurial impression. For this purpose, from two to four grains of calomel may be given every four or six hours, combined with from a quarter of a grain to a grain of opium;

and, in very urgent cases, the doses may be increased, or the interval between them diminished. If the system do not quickly respond to the calomel thus employed, mercurial ointment may be applied by friction to the inside of the limbs, and as a dressing to the blistered abdomen. The patient almost always recovers from ordinary peritonitis when ptyalism is induced.

In the advanced stages, it sometimes becomes necessary to counteract debility by tonic or stimulant remedies. For this purpose, wine-whey, carbonate of ammonia, and nutritious liquids may be used; but perhaps the best remedy is a combination of oil of turpentine with laudanum or one of the salts of morphia. Sometimes it may be necessary to have recourse to milk-punch, or eggs beat up with sugar, and with wine or brandy and water.

During the activity of the inflammation, the diet should consist exclusively of liquids, and these should be taken in small quantities at a time. Lemonade, orangeade, infusion of tamarinds, solutions of the various syrups made from fresh fruits, orgeat and water, gum-water, barley-water, and the like, while they serve as drink, afford sufficient nutriment to the patient. Ice-water and cold carbonic acid water may also be taken to quench thirst. Rennet-whey may be used, when it is considered desirable to make the diet somewhat more nutritious. Animal broths may become proper before the close of the complaint.

The patient should be kept perfectly quiet in bed, and not allowed to rise for the purpose of evacuating either bowels or bladder. The bed-clothes should be prevented from pressing on the abdomen by crossed segments of hoops, or other contrivance.

Cases of partial peritonitis are to be treated upon the same plan precisely, though with less energy. It is not necessary to take so much blood from the arm, and calomel should, as a general rule, be more sparingly employed.

If the complaint occur in constitutions previously enfeebled by other diseases, or if it be complicated with an adynamic or typhous state of system, it will not admit of the same active depletion, and, in some very low cases, will scarcely admit of depletion at all. Where any doubt exists upon the point, it will be best to employ leeches, to the exclusion of the lancet. The remedy upon which reliance is chiefly to be placed is mercury combined with opiates. Stimulants may sometimes become necessary.

Peritonitis dependent upon perforation of the alimentary canal or other cavity, requires a somewhat peculiar treatment. Depletion may be pushed as far as the strength of the patient will admit; but, as this has generally been much impaired by preceding disease, the remedy must be used with caution. The great indication to be fulfilled is to keep the bowels perfectly at rest, in order that the effused matter may be prevented from travelling, and that the formation of adhesions may serve to limit the disease. This is to be effected by the use of opium in large and repeated doses, so as to maintain the system completely and constantly under its influence. The opium, while it thus puts the bowels, as it were, in splints, answers another excellent purpose, by rendering the system at large less sensible to the shock of the disease. The body of the patient should be kept absolutely at rest, and drinks forbidden, or at least admitted only in such quantities as may insure them against passing through the pylorus. Thirst may be allayed by washing the mouth out with cold liquids, and allowing small pieces of ice to lie upon the tongue. Under any plan of treatment, the case must be considered as almost desperate; but the one described affords some little chance of a favourable issue. One case was successfully treated by Dr. Stokes, of Dublin, upon the opiate plan; and another, probably of this character, already referred to as occurring in convalescence from enteric fever, ended in recovery under the care of Dr. Gerhard and myself. (See *note*, page 349.)

Puerperal peritonitis is to be treated upon the same plan as the ordinary form of the disease; but being, as a general rule, more rapid and violent, it requires, in a proportionate degree, more prompt and energetic interference. It is unnecessary to particularize the remedies, which are absolutely identical with those already mentioned. Attention should be additionally paid to the state of the uterine discharges. The lochia, if suppressed, should be promoted by fomentations or emollient applications to the external genitals; and acrid discharges, if any such exist, should be removed as they appear, while the vagina is carefully washed out by emollient injections. It is also advised, by some writers, to favour the flow of milk by similar applications to the breast, and by resorting to the efforts of the infant, or of some young sucking animal, as the puppy. In the adynamic form of this disease, bleeding is not well borne; the loss of a few ounces sometimes producing great faintness, from which the patient scarcely rises. Still, it is generally proper to try blood-letting; for the diagnosis is sometimes difficult, and the effects of bleeding, and the quality of the blood drawn, are among the most characteristic marks of the affection. Should the pulse become very feeble, and the patient very faint from the loss of a little blood, while the blood which has been drawn is dark, and yields a loose and easily broken coagulum, the inference is, that the case is one of a malignant adynamic character, and the plan of direct depletion should be abandoned. Leeches may often be usefully substituted for the lancet. Calomel, however, combined with opium, and pushed, if possible, to salivation, is the most valuable remedy in this form of the disease. Stimulants and a nutritious diet are also often necessary. It is probably to cases of this nature that oil of turpentine, so highly recommended by Dr. Brenan, of Dublin, is especially applicable. Both sound medical reasoning and experience are, I think, adverse to its employment in the cases of ordinary open inflammation of the peritoneum, whether occurring in puerperal women or others.

2. CHRONIC PERITONITIS.

There are two varieties of chronic peritonitis, differing entirely in their origin, and much in their degree of fatality, which are nevertheless so similar in their symptoms, that it is not always easy to distinguish them. In one, the inflammation is of the ordinary character, and originates in the ordinary causes; in the other, it depends upon tubercles disseminated in the membrane, and serving as a constant source of irritation. I shall first describe the former, and then point out those additional symptoms which may be supposed to indicate the existence of the latter.

Symptoms.—The disease is sometimes original, but, when the inflammation is of the ordinary character, is more frequently a mere sequel of an ill-cured acute attack. In the former case, its commencement is often very obscure, a little pain being sometimes felt in the abdomen, with derangement of digestion, and alternations of constipation and looseness of bowels, which exist for a considerable time without attracting much attention. At length the general health is affected, a little febrile excitement is experienced towards evening, the patient loses flesh and strength, and the disease becomes fully developed. When the result of a preceding acute attack, it exhibits the characteristic phenomena immediately after the subsidence of the primary symptoms. In some instances, it would be difficult to decide whether the disease began in its acute or chronic form; for, even in cases which might be considered as belonging to the latter, the pain is severe at first and afterwards diminishes; and the truth appears to be, that there is no distinct line of division between the two varieties.

When the complaint is fully formed, there is usually slight pain in the abdomen, which in many instances is scarcely felt unless under direct pressure, or on the occasion of some shock or jar, such as that produced by a false step, or the motion of a carriage, or some effort on the part of the patient, such as coughing, straining, &c., which causes a sudden concussion or compression of the abdominal viscera. Sometimes the pain and tenderness are confined to one spot, sometimes are diffused or variable. There is occasionally a sense of heat in the epigastrium. The abdomen is sometimes swollen in consequence of effusion into the cavity; but, where this is not the case, it may be even flatter than in health, in consequence of the tension of the muscles. In the former case, there is dulness on percussion, often more or less fluctuation, and sometimes an edematous condition of the feet and legs. In the latter, the abdomen is firm and elastic to the touch, and often more or less unequal, from the irregular formation of adhesions, and the developement of tumours or of sacs within the folds of the peritoneum. Occasionally the abdominal effusion is so great as closely to imitate ascites, if not to constitute a variety of that disease.

The appetite is feeble or irregular, and the digestion impaired. In most cases, there is nausea with occasional vomiting, and the bowels are irregular, being either constipated or affected with diarrhœa. Food produces a feeling of weight in the stomach, and, in some instances, causes pain in a particular portion of the abdomen, occurring at a certain interval after eating. The stools are often light-yellow or clay-coloured. The state of the tongue is variable; but generally it is either slightly furred, or smooth, red, and more or less chapped. The pulse is frequent; the urine scanty; the skin usually dry, unless in the latter stages when hectic fever has been developed; and the face pale and expressive of anxiety. The progress of the disease is usually very slow. Strength gradually fails; and the patient, worn out by the constant irritation, as well as by the failure of digestion and nutrition, sinks into a state of extreme debility and emaciation, which terminates at length in death. The fatal issue is sometimes accelerated by the supervention of an acute attack of inflammation. The disease is sometimes complicated in its course by functional disorders of various organs, the action of which is interfered with by adhesions, or tumours formed in the peritoneal cavity. Thus, jaundice may result from pressure upon the gall-ducts, and obstinate constipation from pressure on the bowels. Sometimes the disease is quite latent until near its close.

It is not always easy to determine, during life, whether the disease is or is not connected with tubercles of the peritoneum. Whenever it is protracted and very obstinate, resisting the curative measures employed, and when its origin cannot be traced to a preceding acute attack, to local injury of the abdomen, or to chronic affections of the abdominal viscera, there is strong reason for believing it to be tuberculous. In this form of the disease, a close examination of the abdomen will often detect small tumours consequent upon enlargement of the mesenteric glands; and the external lymphatic glands, especially in the groin, are also occasionally enlarged. The simultaneous existence of tubercles in the lungs, or an obstinate diarrhœa, indicating tuberculous ulceration of the bowels, would be further evidence of the nature of the affection. Some aid in the diagnosis may also be drawn from the general habit of the patient, and his hereditary tendencies.

The disease is always one of danger, but, in the tuberculous form, may be considered as quite incurable. When partial, or dependent on a curable disease of neighbouring organs, or consequent upon an acute attack, and especially when not connected with tubercles, there is reason to hope that it may yield to remedies.

Anatomical Characters.—Not uncommonly there is almost universal adhesion of the peritoneal membrane, in consequence of the effusion and organization of coagulable lymph. Occasionally small spots of lymph are observed thickly strewed over the surface of the peritoneum, which at first sight might be mistaken for tubercles, but are distinguishable by their less regular form, and by being easily scraped from the membrane, while tubercles, being situated in the subserous tissue, are not thus removable. In those cases in which the false membrane covers the peritoneum, it is usually very thick, of a grayish, reddish, or dark colour, often rough, and of an areolar appearance upon the surface, and sometimes of an almost cartilaginous hardness. Sometimes the intestines are so agglutinated as to form tumours sensible externally, and now and then, in consequence of partial adhesions of the peritoneum, sacs are formed, which are filled with liquid, and give an irregularity to the outline of the abdomen. The liquid effusion is variable in quantity, position, and appearance; being in some cases very scanty, in others more or less abundant; sometimes anterior to the bowels, which are compressed into the back part of the abdomen, and sometimes, as before mentioned, partially collected in sacs; occasionally nearly colourless and limpid, with fibrinous flakes, occasionally more or less opaque, and of a yellowish, brownish, blackish, or reddish colour, from admixture of pus or of blood. In some instances, it consists exclusively of pus.

In cases complicated with tuberculous deposition, this is found either in small distinct granulations, or in masses formed by their aggregation, more or less extensively diffused over the peritoneum, and generally attended with false membrane and adhesions. The tubercles exist in all stages of developement. They are usually solid, but are sometimes met with in the softened state, and even opening into the peritoneal cavity. Instances have occurred in which tuberculous matter, deposited in the adhering coats of two intestinal convolutions, has produced ulceration in both, and thus formed a communication between them.

Treatment.—The remedies to be chiefly relied on are rest, occasional leeching, fomentations or emollient cataplasms, warm bathing, blisters, and the constitutional impression of mercury and of iodine. Rubefacient applications to the abdomen, pustulation by tartar emetic, and setons or issues on the inside of the thighs, have also been recommended. Mercury may be used both internally and externally; the ointment being applied by friction over the abdomen, or as a dressing to the blistered surface. Iodine may be used in the same way. Attention should be paid to the state of the bowels, constipation being obviated by laxatives, and diarrhœa by opiates combined with cretaceous preparations. Dover's powder, or the extract of hyoscyamus, may often be usefully given at night, especially in connexion with the mercurial preparations. Diuretics may be employed to promote the absorption of the effused fluid. The diet should be regulated by the circumstances of the case. In the more active stages, it should consist exclusively of vegetable matter; when the strength fails under this rigid course, milk may be added; and circumstances of debility and exhaustion may occur, requiring the use of animal food. In the tuberculous cases, the diet, as a general rule, should be more nutritious than in those of uncomplicated inflammation. In these cases, moreover, a preference should be given to iodine over mercury; and the necessity of counteracting the tendency of general debility to produce tuberculous deposition, may render a resort to bitters, chalybeates, cod-liver oil, and moderate exercise of a passive character, desirable. Should abscesses form with an apparent external direction, their tendency to the surface should be favoured by emollient poultices.

SECTION II.

DISEASES OF THE ABSORBENT SYSTEM.

The absorbent system, besides sharing in the general susceptibility of the body to morbid influences, is, from the nature of its office, peculiarly exposed to certain causes of disease. Receiving not only the effete matters of the general organism, but also the alimentary product of the digestive process, and, possibly, numerous bodies from without, of every degree and variety of noxious power, it must, in many instances, experience the first evil effects of morbid agents; and not unfrequently, it is probable, experiences such effects exclusively; as there is reason to suppose that the glands, and perhaps the vessels themselves, have a modifying influence over the substances absorbed, which often brings them into harmony with the susceptibilities of the system, and thus prevents their injurious influence beyond the structure, into which they have penetrated in their unaltered state. The absorbents, moreover, seem, beyond all other vessels, to be possessed of that continuous sympathy, which transmits an impression from one part to another of the same structure; so that an irritation existing at their origin is very apt to be transmitted for a considerable distance along their course. A slight general sketch of the derangements of which they are susceptible, will be a proper introduction to the more detailed account of those few of their diseases which appear to merit a separate description. The absorbents, as the result of irritation, may act more energetically than is compatible with health, and may thus produce general emaciation, or the wasting of particular parts or organs. They may fall into the opposite state of depression or debility, and, failing to execute their legitimate function, may give rise to morbid accumulation of fluids, constituting dropsy, or of solids, constituting obesity, and various local excesses of growth. As a consequence, also, of deficient action, they may fail in their office of assimilation, and thus allow noxious matters to enter the blood, which might otherwise be rendered innocent, or at any rate be very favourably modified. They are subject to inflammation in all its grades and stages. To the scrofulous or tuberculous degeneration they are peculiarly liable, and are among the most frequent seats of that affection. Involved, as they almost always are, at their origin, in every specific local disease to which the frame is subject, they generally serve as channels by which the affection spreads to neighbouring or distant parts, or pervades the system, and consequently are themselves the first to suffer. Hence, the absorbents or absorbent glands become the seat of syphilis, of scirrhus, of medullary fungus, of melanosis, and of other less strictly defined and understood degenerations. They may become enlarged or varicose, and diminished in their caliber or strictured. Their channel may be entirely closed, giving rise to accumulations behind the strictured point, and consequent rupture of the vessel. Their coats are sometimes ossified, and like other parts are liable to excessive and deficient growth. But most of these affections are very obscure, and scarcely discoverable during life. Some of them must, from the very nature of the case, be, in any particular instance, hypothetical, or at best merely conjectural. Others again are completely lost in the ravages which the disease produces in parts more immediately vital. Of the various complaints, therefore, to which this system is incident, a few only merit a separate notice. Those here treated of are inflammation of the absorbent vessels, inflammation of the absorbent glands, and scrofulous or tuberculous disease of the glands.

Article I.

INFLAMMATION OF THE ABSORBENTS.

Syn.—Angeioleucitis.—Lymphangeitis.

Of inflammation of the lacteals, as distinct from that of the glands which they permeate, and of the lymphatics of the viscera, whether of the chest or abdomen, little can be known during life. Though probably of no very unfrequent occurrence, and sometimes possibly very serious in its results, there are no symptoms by which it can be distinguished from other inflammations, with an approach to accuracy; and the practitioner must content himself with treating the affection according to the visible indications. But inflammation of the external lymphatics is in general sufficiently obvious.

Symptoms, Course, &c.—If the superficial layer of absorbents only is affected, as usually happens when the disease originates in a wound, ulcer, or inflamed point of the surface, pain, increased by pressure, is usually felt along the course of the lymphatics, and simultaneously, or soon afterward, one or more reddish streaks may be observed, commencing at the originating point of disease, or at a greater or less distance from it, and running towards the centre of circulation. These streaks are sometimes straight and sometimes crooked, often interlace with each other, so as to form irregular meshes, and, when examined by the fingers, feel like hard cords. The redness often extends to some distance on each side of the cord, being gradually shaded off into the natural colour of the skin. It is generally of a rather bright tint; but is sometimes dark. Not unfrequently distinct patches of redness occur, irregular and obscurely defined, but usually connected by the lines alluded to. The inflammation travels rapidly until it reaches the lymphatic glands, which become enlarged and painful; and often extends beyond these, spreading as it advances, and giving rise, in some instances, to a diffused erysipelatous redness. The cellular tissue also becomes inflamed, and the whole neighbouring parts swollen and hardened. The hardness, however, occurs rather in nodules than diffusively. The patient now suffers greatly with soreness and burning pain.

When the more deeply-seated lymphatics are exclusively affected, the pain is at first without redness, is deep-seated and shooting, and gradually extends along the course of the vessels. Slight pressure on the surface has little effect, but strong pressure increases it considerably. There is much swelling; and deep-seated irregular hardness may be felt upon a close examination. The surface at first retains its natural colour; but at length becomes reddened; the redness occurring not in lines, but irregularly in patches, and having a pinkish or roseate hue. Both sets of vessels are sometimes simultaneously inflamed; and then, the symptoms of the two are united.

Most frequently the symptoms are much less severe than those enumerated; and often only a few red lines are observable, which are sore to the touch; and give rather a feeling of stiffness than of acute pain. Occasionally, the inflammation of the vessels is so slight that it could scarcely be recognized, but for the swelling and soreness of the glands towards which they run.

The mild cases generally terminate in resolution, under suitable treatment. The severer often run on to suppuration. The pus is generally in separate small abscesses, occupying the seats of previous hardness; but sometimes it is diffused through the cellular tissue, or forms large collections, from which the matter flows copiously when the cavity is opened. Mortification rarely occurs, unless in the very old, or in persons of worn out constitution. Occasionally, however, the cellular tissue sloughs as in erysipelas. In some rare instances, the inflammation appears to assume a chronic form.

The constitutional symptoms vary with the severity of the local disorder. When this is very slight, the system at large is not affected; when intense, the general disturbance is sufficient to involve life in danger. The phenomena are usually those of ordinary symptomatic fever; at first rigors, followed by heat of surface, a frequent and full pulse, furred tongue, thirst, loss of appetite, restlessness, and want of sleep; then, after suppuration, a relaxed skin, often sweats at night, diminution of the strength but not the frequency of the pulse, with a continuance of other symptoms. Sometimes there is nausea or vomiting, and sometimes slight delirium. In bad cases, especially those which result from wounds in dissection, the fever assumes in its progress a typhoid character, with a very frequent and feeble pulse, a dry or gashed tongue, great restlessness and anxiety, subsultus, delirium, &c. Death seldom occurs, unless in constitutions enfeebled by intemperance, or previous disease, or in cases dependent upon the absorption of some poisonous agent.

Most parts of the body are liable to this affection; but it is more frequent in the extremities than elsewhere, especially in the upper, because these are most exposed to the accidents in which it is apt to originate. When it occupies the arm, it runs up, on the inside, to the glands of the axilla, and often spreads to the chest before, behind, and below the arm-pit; producing, in bad cases, extensive erysipelatous inflammation, and subsequent suppuration in these parts. It sometimes occurs, usually in a mild form, in the neck; and has been found by dissection to have existed in the lungs, abdominal viscera, uterus, and thoracic duct, though no symptoms during life can reveal it with certainty in these parts.

Anatomical Characters.—The coats of the lymphatics are thickened, the cellular tissue about them infiltrated and tender, the internal coat sometimes softened though not reddened, and the cavity often filled with pus. Sometimes the caliber is distended with pus, so as to offer the appearance of an abscess; and Amussat details the examination of a chronic case, in which a large abscess in each groin, communicating with the abdomen through the crural arch, proved to be nothing more than distended lymphatics. In this case, the thoracic duct, and the lymphatics of the abdomen, were also found loaded with pus. The neighbouring cellular tissue is in some parts healthy, in others hardened, and in others again destroyed by purulent infiltration.

Causes.—The cause of this affection is, in the great majority of cases, either inflammation in a particular spot, with or without solution of continuity, or the introduction of some acrid or poisonous matter through a wound, ulcer, or abrasion of the skin, or a combination of the two. Thus, the inflammation produced in the toe by the pressure of the nail, is apt to extend up the lymphatics of the limb. Very small wounds, particularly punctured wounds, even the pricking of a thorn or briar, and the bites and stings of insects, will occasionally give rise to the disease. In the last case, the irritation of a poisonous matter is superadded to that of the wound. Among the most common causes is the exposure of a finger or hand, in which there has been some slight wound or abrasion, to the action of irritant animal matter, either in the dead or living body. The author recollects attending an accoucheur affected with this disease, in consequence of an examination per vaginam with a slightly wounded finger. The effect of dissection, whether of a putrefying or sound body, in producing the disease, is well known. Ulcers, and various eruptive affections of the skin also frequently induce it. Thus, impetiginous ulcers of the head and face, and the sores so common behind the ears in children, often give rise to inflammation of the lymphatic glands of the neck, and the intervening absorbents. The deep-seated absorbents may become inflamed in consequence of a contusion, fracture, or deep penetrating wound, and from communicating with collections of various acrid secretions. It has been observed, however, that the latter result rarely takes place, unless the matter has undergone decomposition, and acquired irritating properties by exposure to the air. Similar causes may produce inflammation of the visceral absorbents, and those of the intestines are peculiarly exposed to it, from the frequent existence of inflamed points and ulcerations on their inner surface. In all cases, the vessels are affected either by a propagation of the inflammation from the original point, through what has been called continuous sympathy, or by the absorption of acrid matter which comes in direct contact with their inner surface. But these causes often exist without inducing inflammation of the lymphatics; and the inference is admissible, that there must be at the same time some peculiar condition of system, acting as a predisposition to the disease. This condition is seldom appreciable; but it is highly probable that bad living, sedentary habits, and other agencies calculated to deteriorate the character of the blood, may have some effect in producing it.

Diagnosis.—The only disease likely to be confounded with inflammation of the external lymphatics, is phlebitis or inflammation of the veins. But in this the inflamed cords are larger, of a darker redness, and less disposed to inosculate; the lymphatic glands do not participate in the inflammation; and the redness upon the surface is less apt to have the diffused character of erysipelas. The progress of the disease, too, is more rapid; suppuration occurs more speedily; and the constitution is in general more profoundly affected, in consequence of the passage of pus into the circulation.

Treatment.—The first indication is obviously to remove the cause, if it continue to act. Hence, it is necessary to remove any existing source of irritation from the wounded or inflamed point, and to correct the inflammation by cooling applications, or emollient poultices. In poisoned wounds, as, for example, those which happen in dissection, the application of nitrate of silver is often useful. Might not the tincture of iodine, or a strong watery solution of chlorine, prove advantageous, by chemically decomposing any organic poison existing in the wound?

If the pulse is full and strong, the patient vigorous, and the local disease considerable, blood should be taken from the arm; but caution is necessary; as the nature of the cause, and the constitution of the patient, sometimes give a tendency to a low form of disease, and it becomes, under such circumstances, important to husband the strength. Bleeding can scarcely ever be proper after suppuration has begun. Leeching along the course of the absorbents is a very valuable remedy. Solution of acetate of lead in the proportion of two drachms to the pint, or the officinal diluted solution of the subacetate, should be applied by means of linen cloths to the inflamed surface. Laudanum or acetate of morphia may be added to either solution. Blisters may sometimes be useful; but they seldom remove the disease. I have employed them chiefly to prevent the spread of the cutaneous and subcutaneous inflammation, by applying them at the outer limits of the erysipelatous surface, partly on the inflamed and partly on the sound skin. For the same purpose, as well as for the removal of the erysipelatous inflammation, recourse may be had to the local application of tincture of iodine, or a strong solution of nitrate of silver. Mercurial ointment may also be used; and, if it affect the mouth, will prove so much the more efficacious. When suppuration has begun, it should be favoured by emollient poultices. Blisters sometimes hasten it. When pus has accumulated, free openings should be made for its escape; and care should be taken to assist the discharge, if necessary, by pressure with the hand or otherwise, once or twice a day. If this precaution be neglected, the pus may spread through the cellular tissue, and extend the mischief. Properly graduated pressure, by means of bandages and compresses, is often highly useful in diminishing the cavities, promoting the healing process, and causing the absorption of the edematous effusion.

Internally, the saline cathartics and refrigerant diaphoretics should be given in the early stages. The neutral mixture or effervescing draught, and the antimonials, when there is no nausea, may be selected. Spirit of nitric ether should be added, when the fever is attended with nervous symptoms. After due depletion, opium and ipecacuanha should be given, especially at bedtime; and, if the disease is obstinate, they may be very usefully combined with calomel. When suppuration has taken place, it may become necessary to support the system by quinia, the mineral acids, wine-whey, ale or porter, &c. Nervous symptoms occurring in this stage may be counteracted by infusion of serpentaria and valerian, camphor, and compound spirit of sulphuric ether; and opiates should be continued. If the tongue is dry, very small doses of mercurial pill, combined or not with opium and ipecacuanha, may be given at short intervals until the mouth is slightly affected. The oil of turpentine is also sometimes useful under these circumstances. If the case should be typhous or adynamic from the commencement, it may be necessary to begin early with the tonic and stimulant plan; but such cases have not come under my notice.

The diet should consist, in the early stages, chiefly of farinaceous or mucilaginous liquids, to which, in the more advanced stages, it may be necessary to add rennet-whey, milk, and animal broths and jellies, according to the degree of support required. When there is no fever, and the appetite is not affected, it is sufficient to confine the patient to a vegetable diet.

Article II.

INFLAMMATION OF THE ABSORBENT GLANDS.

Syn.—Lymphadenitis.

This affection may occur wherever there are absorbent glands, whether superficial, deep-seated, or within the great cavities; but, as it comes under observation, it chiefly affects the external glands, especially those of the neck, groin, and axilla. The bronchial glands may be occasionally attacked by common inflammation, and we know that those of the mesentery very often become more or less inflamed in consequence of ulceration or inflammation in the mucous membrane of the small intestines; but we have no means of ascertaining this point certainly during life; and, so far as the treatment is concerned, we must be guided by general principles. The following description has reference to the external glands.

Symptoms, Course, &c.—The affected gland becomes at first swollen, hard, painful, and tender to the touch. If near the surface, it forms an obvious tumour, which is usually oval, with a rather definite outline, and generally somewhat movable. The inflammation, in most cases, soon extends to the neighbouring cellular tissue, thus greatly increasing the tumefaction, which is now less precisely bounded, while the gland becomes fixed. Not unfrequently several glands are inflamed at the same time, thus producing irregularity in the surface of the tumour, perceptible especially by the touch. If the disease is not arrested, in a period varying from one to two weeks, suppuration commences; the skin becomes thinner under the distension, and assumes a dark-reddish or somewhat livid hue; and one or more prominent points in the tumour are observable, where fluctuation may be perceived. The pus is contained sometimes in one, sometimes in several distinct cavities. Occasionally it is confined to the gland, in which case the tumour is circumscribed and somewhat movable; occasionally to the surrounding parts, when the boundary of the swelling is quite indefinite; and not unfrequently occupies both situations. The skin at length ulcerates; and the abscess or abscesses open, discharging a homogeneous healthy pus, sometimes in small quantities, sometimes copiously; and then gradually heal, leaving almost always more or less swelling and hardness, which last for a long time, but ultimately in general disappear.

Sometimes the tumour, before suppuration has commenced, or has made any considerable progress, ceases to increase, becomes less painful and tender, but at the same time harder and more circumscribed, and continues thus for a long time in a state of *chronic inflammation*, with a slight feeling of heat and soreness. The inflammation sometimes takes on at the beginning the chronic form. In this case, the gland slowly enlarges and hardens, continuing circumscribed and movable, with a deep, dull pain; and thus remains, until either some accidental cause induces an acute inflammation which hastens the result, or the tumour, after a long time, passes gradually into the state of resolution or suppuration. When the latter event occurs, the substance of the gland is ultimately destroyed, and its place occupied by the pus, which is confined within its exterior envelope, forming a single cavity. The pus, both in the acute and chronic forms, is destitute of that tuberculous or cheesy matter which characterizes scrofulous disease of the glands.

Acute inflammation of the glands is generally accompanied with more or less febrile disturbance, which differs in nothing from ordinary symptomatic fever. Chronic inflammation, on the contrary, scarcely ever brings the system into sympathy.

The prognosis of this disease, in the external glands, is almost always favourable. When treatment is applied early, before any appearance of suppuration, resolution is very often effected. But, when the skin has begun to assume a reddish or purplish hue, or the slightest fluctuation can be perceived, it is generally futile to attempt to backen the disease, and the practitioner should confine his efforts to the hastening of the suppuration.

Anatomical Characters.—In the early stage of the inflammation, the tissue of the gland is firm, dense, and homogeneous, and presents upon the cut surfaces, numerous dark-reddish points, which mark the orifices of the divided vessels. In the more advanced stage, it is dark-red, easily torn, and infiltrated more or less with effused blood. When suppurating, it is softened, and exhibits at first minute cavities containing a viscid serous fluid, which are gradually enlarged, and at length filled with a yellowish uniform pus. The cellular structure about the gland exhibits, when it has partaken in the disease, the usual evidences of inflammation in that tissue. (See *page* 36.)

Causes.—The causes of inflammation of the lymphatic glands are so exactly those of inflammation of the lymphatic vessels, that it is unnecessary to repeat them here. (See *page* 731.) If there is any difference, it is, perhaps, that the glands are more liable than the vessels to the influence of the ordinary causes of inflammation in other parts. It not unfrequently happens that the gland is inflamed, in consequence of an irritation or irritant carried to it by the vessels, while the latter exhibit no signs of being themselves affected.

Treatment.—General bleeding may be employed when the disease is violent, the constitution of the patient vigorous, and the inflammation at a stage which admits of resolution. Leeching is often very useful, and may be repeated once or oftener, if it be considered very desirable to arrest the progress of the disease, and prevent suppuration. The cold poultice, made with crumb of bread and lead-water, may afterwards be applied with a similar object. Saline cathartics should be given in the early stages, and the patient confined to a vegetable diet. Should suppuration have commenced, or appear inevitable from the prominence of the tumour and discoloration of the skin, all these measures should be abandoned, and the new process promoted by emollient poultices. After an abscess has clearly formed, and fluctuation become distinct, a free opening should be made by the lancet. By allowing the abscess to open itself, the practitioner endangers, in some instances, extensive injury of the cellular structure, and such a thinning of the skin, as to cause great destruction of this tissue, and consequently a large ulcer, and ultimately a deforming cicatrix. If pus appears to exist in distinct cavities, each one of them should be freely opened.

In cases disposed to assume the chronic form, or in those originally of that form, after due depletion by leeches, repeated blisters will often be found useful. Various other discutient applications may also be resorted to, such as the compound galbanum plaster, the ammoniac plaster, the mercurial plaster, the mercurial ointment, and various unctuous preparations of iodine, as the simple or compound ointment of iodine, the ointment of iodide of potassium, and that of iodide of mercury. The most effectual applications are those of mercury and iodine.

Article III.

SCROFULOUS INFLAMMATION OF THE ABSORBENT GLANDS, or EXTERNAL SCROFULA.

Syn.—Scrofulous Adenitis.

All the absorbent glands, whether external or internal, are liable to scrofulous inflammation. But there is so much difference, both in the course and progress of the disease, according as it occupies the glands within or those without the great cavities, that it requires a distinct consideration in these two positions. I shall treat of it, under the present head, as it occurs in the external glands, constituting ordinary external scrofula.

Symptoms, Course, &c.—The first symptom which usually calls attention to the existence of the disease is an enlargement of one or more of the glands, which has come on almost imperceptibly, and increases for the most part very slowly. The tumour is hard, somewhat elastic, usually oval, pretty well defined, and more or less movable, especially when near the skin. When several neighbouring glands are affected, though isolated at first, they often become aggregated as the disease advances, forming a large, irregular mass, with an uneven, slightly lobulated surface. In the early stage, they are in general nearly or quite free from pain, and from the other marks of inflammation, with the single exception of tumefaction. Sometimes, without any obvious cause, they cease to advance, becoming indolent, and remaining in this state for months or even years, and then again resume their activity.

Not unfrequently, under proper treatment, the tumour or tumours gradually disappear, leaving in some instances no traces, but in the greater number, perhaps, slight glandular enlargements which continue during life. When allowed to pursue their own course, they generally proceed to suppuration; and this often happens even under the best treatment. A higher grade of inflammation now supervenes, extending frequently to the neighbouring cellular tissue, and sometimes producing considerable pain, heat, and even febrile symptoms. The tumour becomes less movable in consequence of adhesion to the neighbouring cellular tissue, and to the skin, which is warm, tender to the touch, and often reddened. Fluctuation is now evident, and is felt equably over the tumour, or in distinct points, according as the pus is contained in one, or several cavities. At length one or more openings are produced, and a liquid is discharged, which is sometimes true pus, sometimes a puruloid serum mixed with a curdy matter, considered identical with the tuberculous deposit. Frequently, pus first escapes, and afterwards a mixture of viscid serum and the curd-like matter alluded to. The latter very generally appears when the substance of the gland suppurates. Occasionally the cellular tissue is the exclusive seat of suppuration; in which case, the liquid may consist of genuine pus alone. The resulting abscess is usually very slow to heal, continuing for a long time to discharge its characteristic matter, and sometimes forming an obstinate fistulous sore, with the skin about its orifice, smooth, shining, and of a purplish or violet hue.

It often happens that the skin over the abscess ulcerates, leaving an open sore, of an unhealthy, characteristic aspect. The edges are irregular, often undermined, sometimes hard, swollen, and obtuse, sometimes thin and flabby, and dull-red or purplish. The bottom is uneven, light-red or grayish, with soft indistinct granulations, giving rise to a copious serous discharge, with curd-like flakes. The ulcer is often very obstinate, and frequently changes its form, in consequence of partial cicatrization, or the extension of ulceration, or of both these processes going on at the same time in different parts. It is very uncertain in its progress, sometimes appearing as if about to heal, and then again breaking out, in consequence frequently of inappreciable changes in the state of the system. It is seldom attended with much pain. Upon healing, it is apt to leave an irregular, rugged, and unsightly cicatrix.

The superficial glands of the neck are most frequently affected, and next, those of the axilla, groin, and mammæ. The disease sometimes also attacks the more deeply seated glands. It is apt to run from gland to gland, along the course of the absorbents in which it originates. In the neck, there is sometimes a chain of diseased glands extending from the ear to the clavicle, and even within the chest. Sometimes both sides are affected, sometimes only one. In the former case, the tumours are apt to be larger on one side than the other. The diseased superficial glands are distinguishable from the deep seated by their greater prominence and mobility.

The constitutional symptoms vary with the stage. Even before the appearance of the tumours, a certain disordered condition of the system is often obvious to a close inspection, especially in very severe cases; and peculiar physical characters, even in the healthy state, are thought to mark a predisposition to the disease. These have been detailed sufficiently under the head of tuberculous or scrofulous disease. (See *page* 113.) The incubative stage, or that which precedes the tumefaction, if open enough to be observed, is marked by a greater or less degree of languor and dejection, defective or irregular appetite, loss of colour and of flesh, occasional erratic pains in the bones and joints, and slight febrile paroxysms. Certain local symptoms are sometimes also observable. The mucous membranes are apt to become inflamed, especially that of the nostrils, which discharges a thin excoriating fluid, and is attended with swelling about the nasal orifices, so as to impede the entrance of air. The upper lip is often swollen and chapped in the middle. In some cases, the conjunctiva is irritated or inflamed, and the edges of the eyelids become affected in such a manner that the eyelashes drop out. The last joints of the fingers are occasionally swollen, and a disposition in the nails to curve forward at their extremities has often been noticed. In many cases, however, the tumours occur in the midst of apparent health, and, as before observed, are generally the first symptom which attracts attention. When constitutional symptoms precede them, they generally become ameliorated after the glands have begun to enlarge. But, as the disease advances, especially when severe, the system sympathizes with the local affection, more or less fever is often experienced, and the appetite and strength, which had improved for a time, again begin to fail. In the last stage, when suppuration has been established, and the patient labours under the exhausting and irritating influence of large abscesses or ulcers, hectic symptoms often occur, with various nervous derangements, and, in the adult female, with disorder of the uterine functions. In very mild cases, however, the disease may run its whole course, with little if any observable disturbance of the constitution.

When the scrofulous tendency is strong, the local developement is not always confined to the glands. Indolent swellings occur in the subcutaneous cellular tissue, in various parts of the body, which ultimately become abscesses, or ulcers, with pus similar to that found in the glandular tumours. Abscesses also sometimes form under the fasciæ, or in the cellular tissue between the muscles. The skin occasionally ulcerates in consequence of a morbid condition of its own tissue, forming open sores of a very intractable character. Certain obstinate cutaneous eruptions, which sometimes attend the complaint in its progress, are supposed to have their origin in the scrofulous taint. Chronic inflammation of the conjunctiva and eyelids is not unfrequent; and the mucous membranes generally are more or less subject to the same vitiation. Disease of the joints, periosteum, or bones may complicate the glandular affection; though more frequently, when the morbid tendency finds a vent through these avenues, it leaves the glands untouched. External scrofula is also sometimes associated with a similar condition of the internal glands, and with those fatal derangements which result from the deposition of tuberculous matter in the vital organs, or the serous tissues investing them. It occasionally happens that the internal alternates with the external disease; and, though the two are, as before stated, sometimes associated, it may be considered true, as a general rule, that, in cases of a strong tuberculous or scrofulous diathesis, a direction to the external glands serves as a safeguard, in some measure at least, against the much more dangerous affections of the lungs, brain, peritoneum, and mesenteric glands.

The duration of external scrofula varies exceedingly. Sometimes, in slight cases, it begins to retrocede almost immediately, under proper treatment, and finishes its course in a few weeks; while, in other instances, it resists all treatment, and runs on for many months, and even for years. Generally, however, it sooner or later terminates favourably, unless complicated with or replaced by disease of the bones or joints, phthisis, tabes mesenterica, or some other internal tuberculous affection.

The disease is most frequent in children, from the close of the first dentition to the period of puberty. It is said to be more frequent in females than males; and the negro, or person of mixed blood between the negro and white, is much more subject to it than the pure white. The attack usually commences in the winter or spring, and the symptoms are often ameliorated during summer, to resume their original violence upon the return of cold weather.

Anatomical Characters.—In the first stage, there is merely an enlargement of the gland, without any striking alteration of the tissue, unless that it may be somewhat redder and firmer than in health. As the tumour advances, it becomes still harder, exhibiting a granular structure, and a grayish colour. Tuberculous matter is then deposited either in the form of distinct granulations, or of irregular infiltration, or of roundish masses, isolated or agglutinated. The proper tissue of the gland is now more or less absorbed, and sometimes wholly disappears. In the advanced stage, abscesses are observed, sometimes only one or two, sometimes several, containing pus, or tuberculous matter in various states of softness.

Causes.—There can be no doubt that a peculiar state of system often exists, either inherited from the parent, or derived from the circumstances of early infancy, which constitutes a predisposition to this complaint. There is, I think, as little doubt, that a similar predisposition may be created in individuals, previously free from any peculiar morbid tendency, by the operation of certain causes which lower the grade of the vital forces, and vitiate or impoverish the blood. Such causes are a meagre and unwholesome diet; confined and contaminated air, especially that of crowded apartments; sedentary occupations; long exposure to cold, especially after a previous habitual exposure to heat, as in those who remove from a warm to a cold climate; a damp atmosphere; excessive and exhausting indulgences; continued mental depression; and finally, the influence of various diseases, as smallpox, scarlet fever, measles, syphilis, &c. The state of system which may be considered, in some cases, as merely predisposing to the disease, often becomes absolutely morbid by an excess of the influence which produced it, and thus passes directly into the disease itself. The agencies above mentioned as predisposing, thus become immediate causes. In other instances, the predisposition is called into action by exciting causes, among which the most prominent are those which give rise to inflammation. It is very certain that this affection has a strong tendency to develope scrofulous disease, where the predisposition exists. The complaints above alluded to as sometimes co-operating, by the debility they induce, in establishing a predisposition, oftener operate as exciting causes. Upon the whole, the most frequent sources of external scrofula are probably inheritance, and the combined influence of a cold, damp, and variable atmosphere, with depressing habits of life. The disease is most common in temperate latitudes, where the vicissitudes of weather are most experienced, and sufficiently effective measures are not resorted to, as in the extreme north, in guarding against the cold. It is less frequent in the United States than in Europe, because the mass of the population in this country enjoy more abundant means of physical comfort.

Nature.—The nature of scrofula has been discussed under another head. (See *page* 115.) It will be sufficient here to observe that a question has been made, whether the original local affection is a peculiar inflammation leading to the deposit of tuberculous matter, or whether the deposit of this matter constitutes essentially the first step of the disease; the inflammation resulting from its presence, as from that of any other foreign substance. In answer to this, it may be stated that dissection often shows the existence of a low grade of inflammation before any tuberculous matter has been secreted; while, in some cases of scrofula, inflammation of the same slow and obstinate character as that of the tuberculated glands sometimes occurs, in one part or another of the body, without the obvious secretion of the characteristic cheesy or curdy substance. The inference is, that, in a system predisposed to scrofula, the occurrence of inflammation often leads to the tuberculous deposition, which forms the peculiar feature of the complaint; and that the existence of the predisposition which leads to this deposition, is capable of impressing a peculiar character upon inflammation arising from any ordinary cause. But it would be altogether premature to state that a low grade of inflammation necessarily precedes the tuberculous deposit. There is, on the contrary, reason to believe that this matter is often eliminated, whether in consequence of a species of vascular irritation, whether from the state of the blood, immediately from the blood-vessels, without the slightest preceding inflammation; and the truth probably is, that the state of system which leads to this deposit, is capable also, without the deposit, of giving a somewhat peculiar character to the inflammatory process. But, whatever may be the origin of the tuberculous matter, there can be no doubt that, when once secreted, it serves, like a foreign body, as the cause of the subsequent inflammation, suppuration, ulceration, &c., which are necessary for its discharge; and that, as it is the chief source of the obstinacy and danger of the case, it must also be the chief object of solicitude.

Diagnosis.—Scrofulous inflammation of the glands is distinguished from ordinary chronic inflammation of the same parts by the greater hardness of the tumours, their less degree of tenderness upon pressure, their longer continuance and greater indisposition to yield to treatment, their frequent complication with other scrofulous affections, and by the state of system which precedes or attends them. The practitioner will also be influenced, in forming his judgment, by the hereditary or family influences, which may have served to create a peculiar predisposition in the patient. When, upon the occurrence of suppuration, the curdy matter above referred to is discharged, there can be no doubt as to the scrofulous nature of the case.

Treatment.—The point that should be first aimed at is the correction of the peculiar state of system in which the tuberculous deposit, and the other characteristic morbid phenomena of scrofula, originate. While this condition remains, our efforts to correct the local disease will at best be useless, and may be very injurious. Either the tumours will resist our remedies, or, if they yield and disappear, the diathesis will exhibit itself in disease of some other and more dangerous part. It is no uncommon event for the recession of scrofulous swellings upon the neck, or in other external situation, to be followed by pulmonary consumption. Instances of this kind have come under the notice of the author. The late Dr. Parrish, of Philadelphia, whose experience in this form of disease was ample, had so much dread of such translations, that he always employed measures calculated immediately to discuss scrofulous tumours with great caution, and generally preferred leaving them entirely alone, addressing his remedies solely to the system. That the swollen glands are sometimes relieved exclusively by local means, and with impunity, only proves that, in mild cases, the morbid tendency may exhaust itself by the first demonstration, and cannot be admitted as a justification for a similar course, in cases where the tendency may be much stronger and more permanent.

In order to correct the state of system, it is of the utmost importance to remove the causes which may have produced, and may still be sustaining it. The patient should be surrounded with circumstances most favourable to the production of sound health, without undue excitement. The vital forces should be invigorated, and the vital actions moderately supported; but care should be taken not to stimulate the latter beyond the healthy standard. A fresh, pure air at all times, and exercise within the limits of fatigue, are among the most efficient remedial measures. If the patient be compelled to labour for a livelihood, he should, if possible, select an avocation in which the muscles generally might be called into action, and which would not require confinement to close, and especially to crowded apartments. Among the worst situations for a scrofulous patient are the crowded wards of an ill-conducted, and over-peopled hospital. The diet should in general be simple, digestible, and nutritious, but not stimulating. Farinaceous substances, the more easily digested fruits and vegetables, milk, meats in moderation, and especially boiled meats, may be employed. Should the patient find himself over-stimulated by animal food, he should diminish the quantity, or abandon it for a time. But, in relation to diet, reference must be had to the stage of the disease, and the state of the system. Should the local inflammation be considerable, or any febrile excitement exist, as sometimes happens in the earlier stages, it would be proper to confine the patient to vegetable food. In the stages of debility, on the contrary, the more stimulating kinds of animal food become advisable, and sometimes necessary. The clothing should be such as to preserve the temperature of the surface as nearly equable as possible; and for this purpose garments of wool should be worn next the skin. The mind should be kept in a state of moderate and agreeable occupation, neither overworked on the one hand, nor allowed to prey upon itself by utter idleness on the other; and efforts should be made to produce and sustain a cheerful flow of spirits, or at least a feeling of placidity and contentment. The injurious influences of climate should be obviated, as far as possible, without sacrificing the all-important requisite of exercise in the open air. Many of these conditions may be fulfilled by a sea-voyage, or by travelling on land, especially if the course of the patient be directed towards a warm climate during winter. Where long journeys are impracticable, excursions, within the means of the patient, to watering-places, or to the seashore, should be recommended; and great advantage will sometimes accrue, in the case of adults, from their performance on horseback. The waters of many of the springs, employed both internally and externally, will be found to add to the various other advantages of these excursions; and few remedies are more efficacious in scrofulous affections, where the lungs are not involved or suspected, and especially in the cases of children, than sea-bathing and a residence by the sea-side. Experience has shown that such an exposure is peculiarly unfavourable to persons consumptively disposed, and to such persons, even though affected with external scrofula, the sea-shore should not be recommended.

In addition to the measures above advised, care should be taken to keep all the functions as nearly as possible in their healthy state. If any one of the secretions be deranged, deficient, or excessive, it should be corrected by the appropriate remedies. Constipation should be obviated by means calculated not to injure the tone of the bowels, or depress the general strength. Excess of acid in the stomach, or elsewhere, should be neutralized by lime-water, or one of the alkaline carbonates. Excitement should be equalized by supplying its deficiency in particular parts by artificial measures. Thus, if the feet and hands are habitually cold, and the surface of the body habitually pallid, frictions, champooing, gentle slapping upon the skin, rubefacient liniments, and warm stimulating pediluvia or baths, as of common salt, mustard, nitromuriatic acid, &c., should be resorted to. Internal inflammations should be counteracted, as far as may be, without exhausting the resources of the system. Hence, local depletion, counter-irritation, the antimonials and other refrigerant diaphoretics, and the saline cathartics, should be preferred to free depletion by the lancet. The same rule is applicable to the treatment of any febrile excitement that may attend the developement of the tumours.

The state of the blood should be attended to, and, if a deficiency of red corpuscles be observed, as may not unfrequently happen, it should be supplied by means of animal food, and the use of the chalybeates. The preparations of iron are, indeed, among the most efficacious remedies in scrofulous affections. They act directly by their tonic power, and indirectly by increasing the richness of the blood. Those should be preferred which are at the same time least irritating to the stomach, and most readily enter the circulation.

The pills of carbonate of iron of the Pharmacopœia, the powder of iron, the subcarbonate, the tincture of the chloride, and the solution of the iodide, may be employed. Some recommend also highly the wine of iron, which owes its chalybeate virtues to the tartrate of iron and potassa.

There are very frequently, in scrofula, a laxity of tissue and general debility, which call for the use of astringents and tonics. One of the most agreeable and useful of these is pipsissewa (chimaphila, U. S.), which combines a mild astringent and tonic power, and may be given very freely and for a long time with impunity. I have been in the habit of using this remedy largely, and have had reason to be satisfied with its effects. The decoction should be given to the amount of half a pint or a pint daily to an adult, and proportionably to children. In many cases, I have found no other medicine necessary than this, in connexion with a saline cathartic twice or three times a week, during the increase of the tumours. The same indication is met by walnut leaves, which have recently been introduced into use, in Europe, as a remedy in scrofula, and are highly lauded by some French practitioners. (See *U. S. Dispensatory.*) Some of the products of the oak have long been used for a similar purpose. In Germany, coffee made from roasted acorns is a favourite remedy; and baths of a decoction of oak bark are likely to be useful, particularly in children. The simple bitters, such as gentian, quassia, and columbo, may be given in cases of general debility with enfeebled digestion; and, in the latter stages of the complaint, when a more powerful tonic impression is required, to support the patient under the exhaustion of the puruloid discharges and colliquative sweats, sulphate of quinia, or some other preparation of Peruvian bark, may be advantageously substituted, in connexion with wine or the malt liquors. The mineral acids, too, are highly useful under these circumstances, being peculiarly adapted to cases in which night sweats are associated with want of appetite and weak digestion. Nitromuriatic acid is thought, in addition to its tonic effects, to exercise a beneficial alterative influence; and it has appeared to me to be more effectual than the other acids, in the condition referred to. Phosphoric acid has also been highly recommended. The diluted acid of the London Pharmacopœia may be given in the dose of twenty or thirty drops three or four times a day.

Cod-liver oil has been found by experience among the most efficient, if not the most efficient corrective of the scrofulous diathesis. It probably acts by improving the character of the blood, and favourably modifying the nutritive process. It may be given in the dose of a tablespoonful three times a day, and should be persevered in for months, or intermittingly even for years, if the patient continue to improve, and such a perseverance seem necessary to eradicate the morbid tendency.

Still another indication, frequently presented in external scrofula, is to relieve the nervous irritation, the pains, restlessness, want of sleep, and various vague uneasinesses, which attend the advanced stages of the disease. This is to be accomplished by means of narcotics and antispasmodics, especially conium, hyoscyamus, belladonna, and stramonium. The extracts of these medicines may often be advantageously combined with the laxatives, chalybeates, and other tonics employed. The preparations of hops, from their combination of narcotic and tonic properties, are useful under the same circumstances. Opiates, in consequence of their constipating property, should be employed only when the other narcotics fail, or when they may be indicated for the suppression of diarrhœa. A remedy well adapted to the debilitated and irritated condition of system, incident to the advanced stages of the disease, is the cold infusion of wild-cherry bark, which is at the same time tonic to the digestive and nutritive functions, and, through its hydrocyanic acid, sedative to the nervous and circulatory systems.

Various remedies have been introduced into the treatment of external scrofula, with a view to their alterative effect. Some of these, probably, owe their reputation to the circumstance, that the disease frequently runs a certain course, and, in the end, subsides spontaneously, without the employment of remedies. Now, in cases having this disposition—and the category probably includes all those in which the causes of the disease are not incessantly acting—the medicine last employed, before the spontaneous amendment, gets the credit of the cure. It can scarcely, however, be doubted that some of these alteratives are highly efficient in the cure of the disease. Among them, the most important, beyond all comparison, is *iodine.* The efficacy of this medicine has been too variously and abundantly tested to admit of reasonable question. It may be employed in all forms and stages of the complaint, unless, perhaps, when it is attended with febrile excitement. The preparations which may be most advantageously employed, as a general rule, are the compound solution of iodine, the compound tincture, and iodide of potassium. One of these may be preferred to another, according as it is found, upon trial, to agree best with the patient. Upon the whole, iodide of potassium may be considered the safest to commence with. If chalybeates are at the same time indicated, the iodide of iron may be preferred; if mercury, the iodide of that metal. Whichever preparation is given, it should be employed at first in moderate doses, and persevered in steadily for a long time unless some local or general irritation should appear to be occasioned by its use, when it should be suspended. When it cannot well be administered internally, resort may be had to ointments, lotions, or baths; and this mode of application is often usefully combined with the internal. For the modes of exhibiting iodine, the reader is referred to the U. S. Dispensatory. *Bromine* and its preparations have properties closely allied to those of iodine, and may, perhaps, be substituted for it occasionally without disadvantage.

Other substances which have enjoyed considerable reputation in the treatment of scrofula, are the *chlorides of barium* and *calcium*, and various vegetable alteratives, as *sarsaparilla*, *guaiacum*, and *mezereon.* The compound syrup and compound decoction of sarsaparilla are still occasionally used, and probably with advantage, in cases in which it is desirable to sustain a gentle excitement of the various secretions, and particularly that of the skin. The two chlorides mentioned, though probably not wholly destitute of efficacy, have been almost entirely superseded by the preparations of iodine. *Sea-water*, taken internally, has been thought useful, through the chlorides which it contains. *Mercury* has been highly recommended; and so far as concerns the removal of the tumours, will probably often prove effectual, especially in the early stages. But at present its use is generally considered hazardous, and has been abandoned by the most prudent practitioners, at least in reference to its sialagogue action. It is thought, when pushed thus far, to interfere with the healthy processes of the system, and thus to favour the scrofulous diathesis; so that, though the glandular affection might be relieved, there would be danger of tuberculous deposition in other and more vital parts. There may, however, be complications, which would justify the moderate use of mercury in external scrofula; as, for example, when this disease is associated with chronic hepatitis, or secondary syphilis. In such cases, it should be used with caution, and the *iodide of mercury* would be a convenient form for exhibition. Small doses of the chloride of mercury, with the preparations of sarsaparilla, have been much used, in cases of combined scrofula and syphilis.

Phosphate of lime has been recommended by Dr. Beneke, a German physician, in ulcerous and rickety affections, of a scrofulous character, upon the ground that, as it is essential in the formation of cells, it is likely to prove useful where there is deficiency in cell-growth. The remedy is an old one in rickets, and had been generally abandoned as inert, until brought forward under these new auspices. Since the publication of Dr. Beneke's observations, it has acquired a certain popularity, especially in connexion with other phosphates, as those of iron, soda, and potassa; but, when it is considered that there is an abundance of these salts in our food, and that much of them is constantly thrown off from the system, even in scrofulous affections, as the result of the disintegration of the tissues, the inference seems fair that it is not so much the phosphates that are wanting, as the due power to make use of them.

Very advantageous impressions may often be made in scrofula by different kinds of bathing. When there is a depressed state of the system, and yet vigour enough to insure reaction, the cold bath, employed daily or less frequently, will often prove an excellent tonic. Hence, in part, the virtue of sea-bathing already alluded to; but it is probable that the saline contents of the water of the ocean, such as the chlorides and iodides, are additionally advantageous, both by a stimulant action on the skin, and an alterative action on the system. Sea-bathing may be imitated by the use of cold baths impregnated with these salts artificially. When, instead of requiring a tonic impression, the system is in a febrile state in consequence of the local inflammation, the warm bath, as one of the mildest and at the same time most efficacious sedatives that can be employed, should be substituted for the cold-bath. Sulphur-baths have been useful as an alterative in external scrofula, and especially when consisting of the natural sulphurous waters, such as those of the springs in the mountains of Virginia, of the Blue-lick springs in Kentucky, and the Avon and Sharon springs in New York. Dr. Simpson, of Edinburgh, having observed that persons working in wool-factories are seldom affected with scrofula and phthisis, and ascribing the exemption to the oil with which their skin comes incessantly into contact, proposes the external use of oil as a remedy and prophylactic in these affections.

In the treatment of external scrofula, reference must always be had to the stage of the disease, and the state of the system. In the early period, when tonic medicines are indicated, those of the mildest character should in general be selected. If, as often happens, there should be some excitement of the pulse, gentle purgation with sulphate of magnesia, or other saline cathartic, given twice or three times a week, is not only well borne, but often proves highly advantageous by diminishing the excitement, and at the same time sustaining a moderate and safe revulsion from the seat of the disease to the long course of the bowels. Should the excitement be considerable, and the general vigour of the system little impaired, a combination of jalap and bitartrate of potassa may be substituted for the less active cathartic. Under this treatment, especially when combined with the use of the decoction of pipsissewa, the patient often gains instead of losing flesh. In the more advanced stages of the disease, or at any period, if the debility is considerable, rhubarb, aloes, or some mild laxative which is without the property of materially increasing the intestinal exhalation, such, for example, as sulphur, should be preferred. It is to the last stages, when the system has become much exhausted, that the more actively tonic and stimulant plan of treatment is adapted. Cod-liver oil and the preparations of iodine may be employed at any stage, unless the system be in a state of inflammatory excitement.

Local Remedies.—For reasons already given, local measures should always be employed with caution. When inflammation is considerable in the gland, and especially when it extends to the surrounding cellular tissue, leeches and the saturnine applications may be resorted to. In the more indolent states of the tumour, if its dispersion be considered advisable, lotions or ointments of iodine, or the iodide of potassium or of lead; mercurial ointment; common salt, applied in solution or in the form of cold poultice; ammoniacal liniments; and plasters of the stimulating gum-resins, as of ammoniac and galbanum, may be used with some effect, especially if applied in the earlier stages, before the deposition of tuberculous matter. When suppuration appears inevitable, it should be favoured by emollient poultices; and the abscess, when formed, should be opened by the lancet. Should the abscess degenerate into a fistulous sore, the sinuses should be excited by stimulating injections, or distended by sponge-tent, or laid open by the knife. When ulcers are formed, they should at first be treated with mild dressings. If indisposed to heal, they may be stimulated by resin cerate, the ointment of red oxide or subnitrate of mercury more or less diluted, that of iodide or biniodide of mercury, weak nitric acid, and other similar applications. The ointment of iodide of lead has also been very strongly recommended. When the ulcer is flabby, and disposed to form fungous granulations, chalk, dried alum, nitrate of silver, the vegetable astringents, Peruvian bark, &c., may be resorted to. If fetid and gangrenous, chloride of soda or lime, creasote, and the fermenting poultice are suitable applications. Should acute inflammation supervene, it should be corrected by emollient poultices. To obviate the danger arising from the cure of the local affection, it has been recommended to establish a steady external revulsion, by means of setons or issues in the arms or legs.

Prophylactic Treatment.—In persons known or strongly suspected to have the scrofulous predisposition, it is of great jmportance to prevent the developement of the disease by suitable prophylactic treatment. The measures to be employed are identical with those already mentioned as calculated to obviate the causes of the disease, and need not be again enumerated. But the care of the physician should extend even beyond these. When a scrofulous female is likely to become a mother, or even when the defect lies upon the side of the male parent, the utmost care should be employed, during pregnancy, to keep her in a sound state of health; and the same care should afterwards be extended to the period of lactation. If the mother positively labour under the disease, she should relinquish to a healthy and vigorous wet nurse the nourishment of the infant. The child should be weaned at the end of a year, and then fed with milk, farinaceous substances, and a portion of light animal food; and these should be commenced with, even before the breast has been relinquished. Attention should be paid to the clothing of the child, who should be kept perfectly clean, exposed freely to the fresh air, and early accustomed to active exercise. The mental precocity, which is a not unfrequent attendant of the scrofulous diathesis, should rather be repressed than encouraged. The physical rather than the mental education should engage the solicitude of the parent; and, when the time comes for the choice of an occupation, the attention should be directed to one, which would lead necessarily to frequent or habitual exercise in the open air.

Article IV.

DISEASE OF THE BRONCHIAL GLANDS.

These glands, from ten to twenty in number, are seated about the bifurcation of the trachea, and its bronchial ramifications, which they accompany for some distance into the pulmonary tissue. It should be recollected that, though reddish in early life, and afterwards grayish, they ultimately often assume a black colour, which is not to be considered an evidence of disease. The absorbents of the lungs pass through them; and the change in their colour corresponds with a similar change that takes place, to a certain extent, in the lungs themselves.

The bronchial glands are liable to all the diseases which affect the same structure in other parts of the body. They may be affected with inflammation, acute or chronic, may become scrofulous or tuberculated, and may be the seat of cancerous growths. But their diseases generally offer no signs by which they can be certainly recognized during life, and are often first revealed by dissection. The glands may be considerably swollen, and indeed sometimes attain a great magnitude, without producing any material embarrassment of respiration. Even when pressing upon the air-passages, they do not always occasion difficulty of breathing, probably in consequence of the gradual manner in which their encroachments take place. Another circumstance which prevents an accurate diagnosis is the very frequent coexistence of other diseases, the symptoms of which completely mask those of the glandular affection. Sometimes, however, these tumours do produce dyspnœa by compressing the windpipe or bronchia, and, according to Dr. Carswell, even give rise to symptoms of obstructed circulation, by diminishing the caliber of the great blood-vessels. Andral relates a case in which he ascribed great feebleness of respiration, observed upon one side of the chest, without the loss of sonorousness on percussion, to the probable compression of one of the principal bronchia by a mass of tuberculated glands. (*Clinique Médicale*, iv. 250.) Dr. Williams states that he has seen tumours of these glands "pushing out the sternum or the ribs on one side, and causing dulness at those parts, and symptoms of displacement of the lung further down." (*Lect. on the Physiol. and Dis. of the Chest.*) When there is cough and more or less dyspnœa, together with dulness upon percussion in the interclavicular space, or over the upper dorsal vertebræ; when the upper part of the sternum and the neighbouring ribs are unnaturally prominent; and when, along with these symptoms, is an absence of the signs of aneurism, or other known organic disease of the chest, the existence of enlargement of the bronchial glands may be reasonably suspected, especially if the patient be very young. But, even should there be conclusive evidence of such enlargement, which is scarcely possible, it would still be difficult to determine the character of the affection; and any inference upon this point must be more or less conjectural. The few remarks which follow will be confined to the subject of inflammation and tuberculous disease of the glands; as other affections are so uncertain, that nothing could be profitably said in relation to them.

Inflammation of the Bronchial Glands.

This may be acute or chronic, and is probably, in the greater number of cases, the result of inflammation of the bronchial mucous membrane. At least, in those post-mortem examinations in which the glands were found inflamed, Andral states that he generally observed redness of that membrane. Indeed, such a result is in accordance with the general fact, that irritation is apt to be propagated to the absorbent glands which lie in the course of the lymphatics running from the part affected. But the disease does not always arise from this cause. It is sometimes original, advancing even to suppuration, with discharge of pus into the trachea or one of the bronchia, without any evidence of preceding or attending bronchitis.

Should a case occur, presenting pain beneath the upper part of the sternum, or deep in the chest towards the corresponding portion of the spine, together with the symptoms before mentioned as indicative of enlargement of the glands; should there also be fever, cough, and expectoration of purulent matter, followed by a disappearance of the symptoms, without the evidences of inflammation in any other part of the chest, and without the peculiar signs of a strumous state of system, there would be reason to suppose that the disease had consisted in acute inflammation of the bronchial glands. A moderate degree and longer duration of these symptoms, with the same termination in suppuration and recovery, would mark a chronic affection of the same kind. Should the same symptoms be presented, with the exception of the purulent discharge, and should they yield to the ordinary antiphlogistic treatment, there would be grounds for believing that inflammation had existed, and terminated in resolution.

The affection is more common in children than in adults; and it is not impossible that some of those cases, not very unfrequent in infants, in which pain and oppression of chest, with fever of longer or shorter duration, have been followed by a sudden expectoration of pus with consequent relief, and which have been considered as abscesses in the tissue of the lungs, may have in fact been instances of inflamed bronchial glands.

The treatment of this disease, when supposed to exist, should be conducted on the general principles applicable to inflammation wherever seated. Depletion, general and local, refrigerant cathartics and diaphoretics, revulsion by means of blisters or rubefacients, the antiphlogistic regimen, anodynes to allay cough, and ultimately, should other means fail, mercury, or, in chronic cases, the preparations of iodine internally and externally, would be the proper remedies; care being taken to adapt them in degree to the severity of the local disease, and the general condition of the system.

Scrofulous or Tuberculous Bronchial Glands.

In phthisis, the bronchial glands are often inflamed and enlarged, but not necessarily tuberculated. The bronchial and pulmonary inflammation associated with tubercles gives rise to a sympathetic inflammation in these glands, which may or may not be attended with a deposition of tuberculous matter. The former result is much more apt to take place in children than in adults. In infants of a strumous constitution, whatever provokes inflammation of the absorbent glands is apt to awaken in them the scrofulous action. Thus, while in adults, tuberculous ulceration of the bowels, or of the lungs, may be accompanied with common inflammation of the absorbent glands with which these parts respectively communicate, it not unfrequently happens that, in infants predisposed to scrofula, common enteric or bronchial inflammation gives rise to a tuberculous affection of the same structures. Hence, the complaint of which we are now treating is incomparably more frequent in young children than in persons of mature age.

The disease is so frequently associated with phthisis, the symptoms of which cover and conceal those of the glandular affection, that it can seldom be recognized until after death. Occasionally, however, it occurs without any preceding or simultaneous developement of tubercles in the lungs; and, even when these exist, they are sometimes much smaller in amount than the tuberculous deposit in the glands, and cannot be considered as the source of the latter affection. When the physical signs indicative of enlarged bronchial glands are observed, with little or no pain in the part, with occasional fever, cough, and dyspnœa, which have come on gradually and persisted for a considerable time; when along with these symptoms are marks of a scrofulous constitution, such as swellings of the cervical glands, occasional epistaxis or spitting of blood, tumefaction of the abdomen, &c.; and especially when the patient is under the age of puberty; it is reasonable to suspect the existence of the disease in question. The diagnosis, however, is always more or less uncertain.

The disease is various in its progress, being sometimes rather rapid, but generally slow, and occasionally quite stationary for a considerable time. The tumours now and then attain a very great magnitude, filling the whole posterior mediastinum, or protruding, in young subjects, the bones of the thorax. Pressing upon the air-passages, they occasion inflammation, adhesion, and ultimate absorption of their parietes, thus opening a way for the discharge of the softened tuberculous matter they contain into the trachea or its branches. In this way, there is reason to believe that the diseased glands are sometimes ultimately restored to health. Occasionally also the tuberculous matter deposited in them appears to be absorbed, and, in some instances, its place to be supplied by chalky matter, as happens in certain cases of pulmonary tubercles. But unfortunately the affection is so often complicated with pulmonary consumption, tabes mesenterica, or other fatal tuberculous disorder, that its favourable termination can seldom have any considerable effect upon the general issue.

The complaint has been found on dissection in every stage of developement, including mere tumefaction of the glands, solid tuberculous deposit in their substance, softening of this tuberculous matter, absorption in various degrees of the structure of the air-passages, openings into these passages, and cavities resulting from the evacuation of the softened matter. The glands, moreover, have been observed shrunken, hardened, and chalky, or even bony. Andral states that he never met with perforation of the trachea or bronchia from this cause in adults; while the chalky deposition was most frequent in middle and advanced life. He had generally observed redness or other marks of existing or former inflammation of the bronchial mucous membrane, but not always.

The treatment of this disease, when ascertained, is to be conducted upon the same principles as that of external scrofula. The most important point is to obviate the tuberculous tendency of the system by measures calculated to support the general health and strength, without producing undue excitement; for the danger is much greater from an extension of the disease to the lungs, than from that already existing in the glands themselves.

Article V.

DISEASE OF THE MESENTERIC GLANDS.

Of the absorbent glands of the abdomen, the mesenteric are most frequently diseased; after these, probably, the mesocolic, and next the lumbar; but all are liable, in a greater or less degree, to the various morbid affections to which the lymphatic ganglia are incident in other parts of the body. The remarks which follow, though directed especially to the mesenteric glands, are, in great measure, applicable also to the others. They are confined to the simple inflammation, and the scrofulous or tuberculous degeneration of the glands.

Inflammation of the Mesenteric Glands.

This is a very frequent attendant upon inflammation and ulceration of the mucous membrane of the small intestines, and especially of the ileum. Andral states that, whenever he had found the intestines exanthematous or ulcerated, the mesenteric glands were seriously affected, being enlarged, of a reddish or brownish colour, softened, and sometimes charged with small collections of pus. Those were most diseased which corresponded with the most diseased portion of bowel. (*Clin. Med.*, i. 600.) Louis found them more or less altered in size, colour, and consistence, in all instances of typhoid fever, in which their condition was examined after death. Those were affected which corresponded with the inflamed or ulcerated elliptical patches of the ileum; and the changes observed were the same as those above mentioned. In one instance, a gland was completely converted into pus, which was retained only by a thin sac, and must have been effused into the abdominal cavity, had death been postponed for a few days. (*Recherches sur la gastro-enterite.*) Even the enteric inflammation and ulceration which attend phthisis, not unfrequently give rise to common inflammation of the mesenteric glands. Thus, Louis states that, when the glands were not found tuberculated in these cases, they were often increased in size, and more or less reddened. (*Recherches sur la phthisie.*)

That they are also subject to ordinary chronic inflammation may be inferred from the fact, that, in cases of tabes mesenterica, they are sometimes observed, upon dissection, to be enlarged, compact, and hardened, though less indurated than in scirrhus, and without tuberculous deposit. (Guersent, *Dict. de Méd.*, vi. 439.) It appears that any inflammation existing in the bowels is liable to be propagated to these glands, through the lacteals by which the two parts are connected. It is possible, also, that they may be originally inflamed; but little seems to be known upon the subject. Either the affection is very rare, or so mild as seldom to lead to serious results.

The diagnosis of ordinary inflammation of the mesenteric glands is very uncertain. The disease may be inferred to exist, should a patient, without any scrofulous symptoms, complain of pain, increased by strong pressure, in the central parts of the abdomen, or towards the right iliac region, and at the same time one or more roundish tumours be felt in the same part, by means of a very careful examination. In consequence, however, of the depth of the mesentery, the want of considerable magnitude in the tumours, and the frequently swollen state of the abdomen, this could very seldom happen. The tendency of the disease appears to be towards resolution, or, if suppuration commences, the pus is generally absorbed. The only danger to be apprehended is, that an abscess may form, and open into the peritoneal cavity. There is reason to believe that this event has sometimes occurred. But, more frequently, the pus would probably find a safer outlet into the bowel by means of adhesion and ulcerative absorption. Where the diagnosis is so vague, little need be said of the treatment. Fortunately, the measures calculated to relieve the enteritis in which the affection generally originates, will be all that will be required.

Scrofulous or Tuberculous Disease of the Mesenteric Glands.—Tabes Mesenterica.—Scrofula Mesenterica.—Atrophia Mesenterica.

This disease is confined to no period of life, having been observed in the fœtus of six or seven months, and in old age; but it is most common in childhood. By far the largest proportion of cases occur between the ages of one and ten years. The complaint is not common in this country, at least as a distinct affection. It is more frequent in Europe. Guersent states that, in the *Hôpital des Enfans* at Paris, where no one is admitted under one year, or over sixteen, the proportion of tuberculous mesenteric cases to the whole number of deaths, may be for boys five or six, for girls from six to eight per cent. (*Dict. de Méd.*, vi. 436.) But this was under circumstances, both as regards age and situation, most favourable to the disease. Bayle gives the general proportion at scarcely four in the hundred. (*Ibid.*)

The disease is associated, in the great majority of cases, with other results of the tuberculous diathesis, which are often much more serious than itself, and not unfrequently completely mask its symptoms, so that it is first discovered upon dissection. Louis found the mesenteric glands more or less tuberculated in twenty-three, out of one hundred and two cases of pulmonary consumption. (*Recherches sur la phthisie.*) Chronic inflammation and ulceration of the bowels, so common in the advanced stages of this complaint, are very frequent complications of the mesenteric affection; and it is occasionally associated also with tuberculous peritonitis, chronic hydrocephalus, scrofulous disease of the spine, rickets, tuberculated bronchial glands, and various other forms of scrofula. In most of these cases, it is either altogether secondary, or at most of little comparative importance. Occasionally, however, the scrofulous diathesis appears to expend itself chiefly if not exclusively upon the mesenteric glands, in which case the disease may be distinct and prominent.

Symptoms.—The symptoms which ordinarily attend a case of tabes mesenterica, are very ambiguous. As a general rule, the greater number belong to the associated diseases, and comparatively few to the proper affection of the mesenteric glands. Nevertheless, as they actually occur in this association, it is important that they should be presented in one view. The following are those usually enumerated. The appetite is irregular, sometimes feeble, and sometimes voracious or perverted. Occasionally there is vomiting of glairy matter. The bowels are either costive, or affected with diarrhœa; and the discharges are usually unhealthy, being mucous, bloody, or otherwise discoloured, and sometimes of a clayey or chalky appearance. There is frequent abdominal pain, which is sometimes acute and colicky, sometimes dull and continuous, and is usually increased by pressure. But perhaps the most prominent symptom, and the one generally regarded as most characteristic, is tumefaction and hardness of the abdomen, with general emaciation, evinced especially in the extremities. The features are also shrunken, the surface pale, and the strength greatly depressed. A livid appearance may sometimes be observed beneath or around the eyes. The secretions are often perverted; the breath being offensive, the exhalations from the surface sour or otherwise disagreeable, and the urine scanty and of a whitish or milky colour. The child is usually dull and indisposed to exertion. The pulse is almost always more or less accelerated, especially towards evening, when there is often an accession of febrile symptoms, which are followed by perspiration early in the morning. Cough is a frequent symptom. At length hectic fever sets in, the emaciation becomes extreme, effusion begins to appear in the extremities, and sometimes in the abdomen, and the patient dies exhausted, or is cut off by the supervention of some acute inflammation.

But none of the symptoms above enumerated are absolutely characteristic of the mesenteric disease, and there are none which may not proceed from other causes. The deranged appetite, vomiting, irregular alvine evacuations, and abdominal pains, may be the result of chronic enteritis or intestinal ulceration, which are often present. The chalky stools, instead of consisting, as has been conjectured, of the chyle which is evacuated because unable to pass through the lacteals of the mesentery, are probably in general ascribable to a suspension or perversion of the hepatic secretion, and the milky urine to an excess of earthy phosphates. The swelling of the abdomen may depend on derangement of bowels, or chronic peritonitis, and probably does in general depend mainly on the first-mentioned cause. The emaciation, paleness, hectic, &c., are abundantly accounted for by the extent of tuberculous disease, scattered over various parts of the system. The whole series of symptoms may exist without disease of the mesenteric glands.

Nor is this complaint, when it does occur, necessarily attended with any of the enumerated symptoms. The mesenteric glands occasionally become tuberculated, swell largely, and advance even to the stage of maturation, without perceptibly deranging the health; and the existence of the disease is first revealed by dissection, after death from some other cause. Striking cases of this kind are recorded by Bayle and Morgagni. In one of these cases, the patient is represented as having been very fat, showing that the chyle finds access into the circulation, notwithstanding the disease of the mesenteric glands. The emaciation has been usually ascribed to the non-absorption of the chyle, in consequence of obstruction of the lacteals; but the existence of cases such as the one just mentioned, and the fact that Böker, a German anatomist, was always able to inject the diseased glands with mercury, their absorbents being quite permeable (*Cyc. of Pract. Med.*, Lond. 1835, iv. 149), throw some doubt upon this explanation. There is, in most cases, abundant cause for the loss of flesh in the coexistence of tuberculous disease in various organs, and the exhausting irritation of system which this occasions. In those instances of tabes mesenterica in which no symptoms are exhibited during life, the result is to be ascribed to the absence of inflammation of the substance of the glands, or of neighbouring parts, which, in active cases, always attends the tuberculous deposit. There is reason to believe that, in some of these instances, the disease may run its whole course to health again, undiscovered; the tuberculous matter being absorbed after maturation. But, when of considerable extent, it probably sooner or later becomes active, from the necessity of inflammation and ulceration to the escape of the foreign matter.

In many cases, inflammation of the glands attends the disease from its very commencement, either preceding the tubercles or excited by them, and not unfrequently involving also the corresponding portion of the bowel or peritoneum. There may, at the same time, or may not be more or less of the complications before alluded to; and the symptoms will vary with the amount and nature of the associated affections. The whole train of phenomena above enumerated may be presented, or those only which indicate either enteric, peritoneal, or pectoral disease, besides the mesenteric, according as one or another of these complications may exist.

But what are the symptoms which characterize the affection of the mesentery itself, and which may serve to point it out, whether isolated or connected with others? These cannot be stated with certainty, because dissection very seldom affords the means of verifying the inferences drawn during life; fatal cases being almost always greatly complicated. Conjecturally, however, the following may be stated as characteristic symptoms; viz., a steady dull pain in the centre of the abdomen, extending to the back, and inclining towards the right iliac region; tenderness upon strong pressure either backward from the neighbourhood of the umbilicus or forward from the lumbar region; the increase of the pain by sudden jars of the frame, as by coughing, sneezing, jumping, &c.; and, finally, its perseverance for months or even years, with remission in summer and exacerbation in the autumn and winter. Besides these, a general acceleration of pulse, occasional fever, especially towards evening, loss of colour and flesh, and various sympathetic derangements of the neighbouring organs, such as constipation or diarrhœa, nausea and vomiting, disordered hepatic secretion, &c., might be reasonably expected. The pressure of the enlarged glands, moreover, sometimes occasions derangement in the functions of the contiguous viscera. Thus, according to Andral, by compressing the pylorus, they have simulated scirrhus of this passage, and, by operating in a like manner upon the biliary ducts, have induced jaundice. But the only unequivocal sign of the disease is the actual discovery, by the touch, of hard roundish, or knobbed tumours in the region of the mesentery. It not unfrequently happens that the glands become so much enlarged, especially at an advanced period of the complaint, as to be readily felt upon a careful examination. When this evidence is joined to that of the symptoms above enumerated, and at the same time the patient exhibits signs of a scrofulous constitution, there can be no doubt as to the nature of the case. Hardened feces may possibly be mistaken for enlarged glands; but there can be little danger of such an error, if it be borne in mind that feculent accumulations of this kind are confined to the large intestines, and must occupy a seat different from that of the mesenteric glands.

The progress of tabes mesenterica is very generally slow, often lasting for years. There is reason to believe that it not unfrequently terminates favourably, when not complicated with other incurable affections. In fact, in almost all fatal cases, death is owing much less to the disease of the mesentery than to pulmonary consumption, chronic peritonitis, tuberculous hydrocephalus, intestinal ulceration, or spinal disease, acting severally or in a greater or less degree conjointly. When death results directly from the diseased glands, it must generally be in consequence of the discharge of their contents into the peritoneal cavity. But this is not a necessary consequence of the opening of the tumours, and the escape of their tuberculous and puruloid matter. Cases have occurred in which adhesion to the abdominal parietes was established, and the matter discharged externally by means of ulceration; and there can be little doubt that, by the same process, it sometimes escapes into the cavity of the intestines, and is evacuated per anum. In either of these events, recovery may take place.

Anatomical Characters.—In most cases, the glands are, in the early stages, red, swollen, and somewhat hardened; but sometimes they are entirely free from marks of inflammation, and even paler than in health. The tuberculous matter exists in roundish or irregular granules, which are often more or less aggregated, or in small flat plates or layers; and may be deposited either in the substance of the gland, or immediately exterior to it, beneath its peritoneal covering. It is especially apt to be found in the latter position in those cases which are unattended with inflammation. The substance of the gland, pressed upon by the increasing tubercles, is either absorbed, or forced within smaller limits, and sometimes quite disappears; the glands being transformed into masses of tuberculous matter. These are isolated or connected, and vary in size from that of a pea to that of a hen's egg, or, according to Portal, even the head of an infant. Sometimes the tuberculous matter is deposited in layers between the laminæ of the mesentery. This matter is generally from the first dull white or yellowish, and is very seldom of that gray colour and transparency, which often characterize the commencement of pulmonary tubercles. It undergoes the various stages of softening to which similar deposits are liable elsewhere, and is at length converted into a sero-puruloid liquid, with curdy flakes intermingled. But this condition of the glands is not often observed upon dissection; as death generally occurs from other diseases before the period of complete maturation. Occasionally, glands are found filled with a calcareous or gypseous matter, which has probably taken the place of the tuberculous; and, in some instances, this matter has been observed surrounded by a bony shell.

In relation to contiguous structures, the peritoneum is sometimes perfectly sound, sometimes inflamed to a greater or less extent, with small tubercles between it and the subjacent cellular tissue. The mucous membrane of the bowels may also be either sound, or variously diseased. Sometimes it is red-

dened, especially about the cæcal extremity of the il
ulcerated; the ulcers being small or large, superficial
stages of progress. Not unfrequently the omenta a
tuberculated, and the liver to a greater or less extent

Causes.—The causes of this disease are essentiall
external scrofula. The strumous diathesis necessary t
be inherited, or may be the result of various agencies
vigour of the system and impoverish the blood. (See
of mothers or nurses, themselves scrofulous in fact, o
tendencies, is said to predispose to the disease. As ir
the causes which give rise to the predisposition are of
their long-continued action, to bring on the complaint;
frequently hastened by exciting causes, and especiall
inflame the intestinal mucous membrane. The exa
repelled cutaneous eruptions are among these causes.
be considered the cure of external scrofula by local
modify the general tendencies of the system. Fron
causes, it would be inferred that the disease must b
the poor, and very apt to prevail in large hospitals
and such is really the case. It is comparatively rare
affluent or comfortable circumstances.

Treatment.—Of the treatment very little need be sai
cal, so far as regards constitutional measures, with tha
the head of external scrofula. Any modifications tha
sary would have reference generally to the state of th
which are more frequently disordered in this form o
which attacks the external glands. Few causes are p
in awakening the scrofulous predisposition in the me
testinal irritation or inflammation, and a torpid condi
rise to congestion of the whole portal circle. Hence
attending to the condition of these parts. Constipati
acid or other irritating contents of the bowels should be
vitiated secretion should be corrected, and the liver
increased action. These various indications may be
doses of calomel, daily, every other day, or at longer
alternated with mild cathartics, such as rhubarb, cast
of the purgative salts; and aided by mild tonics and
for by debility of the stomach or bowels. To correct
acids may be conjoined with the tonics and catharti
ferred which may seem best adapted to the circumsta
magnesia or its carbonate, when a laxative effect is i
form of carbonate of lime in an opposite state of the
carbonates or bicarbonates, when neither laxatives nor
It need scarcely be added that, should positive signs o
inflammation exist, recourse should be had to antiphlo
tioned to the strength of the system, and to the violen
General bleeding, however, will seldom be admissible.
frequently, will, under these circumstances, be found
to the other measures.

Another point of treatment in which this affection
external scrofula, is the greater attention which the
In tabes mesenterica, it is of the utmost importance
the maturation of the tumours, and to favour the ab
lous matter. Especial care should, therefore, be take

inflammation of the glands, which accelerates the march of the tuberculous affection, if it do not call it into action. When signs of such a condition exist, leeches or cups should be applied to the abdomen, if the strength of the patient permit, and these should be aided by fomentations, emollient cataplasms, and blisters. In purely chronic states of inflammation, gentle and long continued friction over the abdomen, rubefacient liniments, stimulating plasters, or pustulation by tartar emetic or croton oil, will be preferable. To promote absorption of the tumours, nothing will be found so efficient as the free application of ointment of iodine to the belly, persevered in for a considerable time. Great advantage may also ensue from the use of iodide of potassium internally, in doses as large as the system of the patient will support. This remedy is preferable to mercury, from the circumstance, that, while iodine acts as a general tonic, and rather tends to support the vital actions than otherwise, this remedy, though it may correct existing inflammation of the glands, if pushed to salivation, leaves a condition of debility behind it highly favourable to the increase of the scrofulous diathesis, and consequently to the deposition of tuberculous matter. The use of mercury should be restricted to its purgative action, and its alterative influence on the functions, especially that of the liver.

For whatever else is requisite in the curative, palliative, or prophylactic treatment of this complaint, the reader is referred to the article upon external scrofula. (See *page* 739.) In its earlier stages, much may be expected from appropriate treatment; and, even when the glands have become so much enlarged as to be felt through the parietes of the abdomen, there is no reason to despair. One cause, probably, of the frequent failures is, that the circumstances of those affected are often such as prevent the employment of measures best calculated to obviate the diathesis, such as exercise, fresh air, wholesome and nutritious food, and whatever tends to cheer the mind, and invigorate the bodily functions. When the disease has advanced to suppuration; and hectic fever, with emaciation, night sweats, and colliquative diarrhœa, has set in, little else can be expected from remedies than simple palliation.

SECTION III.

DISEASES OF THE RESPIRATORY ORGANS.

Previously to entering upon the consideration of the individual diseases of these organs, it will be necessary to call attention to certain means of diagnosis, which, being applicable to many of the affections in common, cannot be appropriately treated of in connexion with any one of them exclusively. These may be included under the heads of auscultation, percussion, inspection, manual application, and measurement, which are here mentioned in the order of their importance.

Auscultation.

By this term, in its technical sense, is meant the act of listening to the sounds of the interior of the body, by means of the ear applied to the surface, either directly, or through the intervention of an instrument denominated the stethoscope. The proper methods of practising auscultation are sufficiently explained elsewhere. (See *page* 204.) It is here to be considered only in its application to respiratory complaints.

It may be proper to observe, preliminarily, that the sounds heard in auscultation, or developed in percussion, vary in *quali* independently of those differences which depend on By the *quality* of sound is meant its peculiar character, distinguished from all other sounds, however simil other properties referred to. *Intensity* has reference t *pitch* to that of elevation. Differences in these respe significance in diagnosis.

In employing this method of diagnosis, it is ofte the chest in different stages, and states of respirati are materially modified in these varying conditions; a is evolved in one condition which might not be hea be heard so imperfectly as to lead to incorrect inferen should be first examined while breathing in the ordin afterwards be directed to breathe quickly or forcibly, or to exhaust his lungs more or less completely, to h after inspiration or expiration, or in fine to make a the respiratory act, which may be thought capable cise materials for judgment. As the sounds produce vary greatly in different individuals, so that what w might be quite normal in another, it is proper to c with himself; in other words, to examine the chest especially to examine the two sides of the chest at co to detect any difference that may exist between them. results decidedly different from the other, allowance b few natural diversities, the existence of disease may probable.

The sounds connected with the function of respira jects of this process, are, *first*, those directly resulti expiration, and *secondly*, those of the voice, including

1. In the healthy state of the lungs, two distinct auscultation; one called the *vesicular*, because supp passage of air from the ultimate ramifications of th cells; the other *bronchial* or *tubal*, because generate and probably caused by the air impinging upon thei through them.

The *vesicular sound*, sometimes designated as the heard over those parts of the chest where the prope comes into contact with its walls. It is produced du sults probably in part from the vibrations occasioned cells by the impulse of the air, and in part from th themselves. During expiration, though of the same very faint, and sometimes scarcely if at all percept the circumstance, that the motion of the air now com is at first too feeble to give rise to other than very tween the murmur of inspiration and that of expiratio too short to be appreciated, and the two may practica tinuous. In relation to the character of the sound, i mur, which has been compared to the sighing of a ge leaves, but is best appreciated by applying the ear t chest, where it exists in greatest purity. It does n corresponding points upon opposite sides of the thora lateral and lower portions, where the bronchial tubes varies considerably within the limits of perfect hea intensity by whatever increases the rapidity and for prolonged by a full breath. Thus, when naturally feeble, so as to be perceived with difficulty, it may be rendered sensible by directing the patient to breathe rapidly, or to cough; the inspiration which follows the latter act being usually quick and forcible. Its intensity varies much in different individuals. It is proportionate, in some degree, to the amplitude of the chest, and the thinness of its walls. Hence, the sound is usually more distinct in thin and lank persons, than in those who are fat or muscular. It is above the general average in hysterical women, and men of excitable nervous constitution, in consequence of their rapid breathing. In women the sound is usually louder than in men, and in children much more so than in adults. Hence, the respiration is said to be *puerile*, wherever met with, when the vesicular murmur is very loud. In old age, the sound becomes much weaker, while its duration, which is diminished during inspiration, is increased in expiration. Hence, breathing of this kind is called *senile*. But sometimes, also, even when all circumstances are apparently similar, the respiratory murmur may vary greatly in different individuals, being loud in some and very feeble in others, without any appreciable cause. When, in the same person, the sound is much weaker on one side than at the corresponding part of the opposite side, or when two points on the same side materially differ in this respect, there is good reason to suspect the existence of disease.

The *bronchial* or *tubal* sound has a blowing character, such as may be produced, out of the body, by causing air to pass quickly through a tube. It is harsher than the vesicular, and quite distinct from it. The part at which it may be heard in its greatest intensity is over the trachea, and in that situation it is sometimes called *tracheal;* but this differs only in degree from the sound yielded by the bronchia, and therefore scarcely merits a distinct name. It is perceived, in a somewhat lower degree, over the bronchia where they enter the root of the lungs, and, from that point, gradually diminishes, as the tubes ramify and penetrate more deeply into the pulmonary structure, until it is at length entirely lost. It is heard characteristically at the upper portion of the sternum, and may be distinguished for some distance upon each side, under the clavicle anteriorly, and between the scapulæ posteriorly. It is more distinct, both before and behind, on the right side than on the left, owing to the greater caliber of the tube proceeding to the right lung. That it cannot be heard over the whole chest, is owing to the intervention of the soft spongy structure of the lungs, which deadens the sound, so that it is inaudible unless the tube is large, or very near the surface. The bronchial sound differs strikingly from the vesicular in the circumstances, that it is nearly as loud and long continued in expiration as in inspiration, and that instead of being nearly continuous in these two acts, it suffers a distinct interruption between them. The reason of these differences is obvious. In any given space from which the bronchial sound can reach the ear, the entering and returning currents, being of about equal velocity, and acting through an equal extent of tube, produce about an equal amount of vibratory movement and consequently of sound, both as regards intensity and duration; while, as the entering column is arrested before the returning movement commences in the cells, it is obvious that a certain time must elapse, after the cessation of the sound of inspiration, before the impulse which produces that of expiration can reach the part. Both of these circumstances are wanting at the point at which the current of air begins to return, or, in other words, at the place in which the vesicular sound is generated. In parts of the chest in which the vesicular structure of the lungs exists, while the bronchial respiration is still audible, the two sounds are sometimes so commingled as to be with difficulty distinguished, and the kind of respiration is produced which has been called *rough*, *harsh*, or *rude*.

The sounds of the chest hitherto treated of are thos
They should be well studied on the living subject, in
of comparison with the same sounds modified by di
which may arise from morbid states of the chest.

The *vesicular* sound is liable to various changes.
become morbidly loud and prolonged, the latter alter
especially during expiration. Whatever has a tend
pending, or destroying the respiratory function in o
throw an increased duty upon the remainder, will be lil
in the latter portion more intense. Hence, tight ban
part of the chest occasion a louder vesicular murmur i
effect is produced by obstructions in the bronchial
from a portion of the lungs; by consolidation of the
compression from tumours, effused liquid in the pleur
causes; and even by dilatation of the air-cells, so con
with the performance of their duty. Whatever, too,
bid increase in the frequency and force of respiration,
sity, other things being equal, to the vesicular murm
a pathological sign. On the other hand, the sound ma
or altogether suppressed, in any particular part of t
complete obstruction to the entrance of air into the
struction exists in the tubes conveying the air, or
compression, or want of expansibility of the cells the

Nor is a mere increase or diminution of intensity t
this murmur is liable. It is occasionally deranged in
ence to its duration and continuity. Sometimes it is
mencement of a respiratory movement, but becomes
again, though audible at the beginning, it ceases b
completed. The former irregularity may be ascribed
is capable of resisting for a time the entrance of a
lungs, but is overcome by a continuance of the inspi
bronchitis partially closing the bronchial tubes, and in
ing with a certain but not irresistible force upon t
some obstacle which, though it admits a certain amou
a full inspiration, as in spasmodic asthma, and certai
sion of the air-cells short of obliteration. Sometimes
being thus abbreviated at the commencement or close
ing, coming to the ear in successive irregular fragmen
such as pleurisy or pleurodynia, which renders inspira
its continuity. Still another irregularity is the occu
readily appreciable interval between the sounds of in
attributable to some impediment in the bronchial tu
ready exit of the air, or possibly, in some instances,
permanent distension of the air-cells, as in emphys
also to state, in this place, that agitation of the patien
of an examination, sometimes induces temporarily a co
passages, in which, though the muscles of respiratio
enter the cells freely, and the vesicular murmur is no
inferences, under such circumstances, it is always
examination after the agitation alluded to has subside

The character of the vesicular sound is sometime
has before been stated that, in certain parts of the ch
and vesicular sounds are both heard in the healthy
mingled, forming what has been called the *rough* or

frequently occurs, as a result of disease, in other parts of the chest. It usually depends on a certain degree of condensation in the pulmonary tissue, which renders it a better conductor of sound, without an obliteration of the air-cells. The bronchial respiration thus becomes audible, and modifies the vesicular, which may either be feeble or increased, according as the cells are more or less affected. It is in expiration that this change is more especially observable; the expiratory murmur being increased in intensity and duration, and having more of the harsh blowing character of the proper bronchial sound than the murmur of inspiration. This modification of the pulmonary sound is often of considerable value, as one of the signs of incipient tubercle, pneumonia, or pleurisy.

The *bronchial sound* also is liable to morbid irregularities. Very frequently, in consequence of disease, it is heard without the accompaniment of the respiratory murmur, in parts of the chest where it is usually quite inaudible. Under these circumstances, the respiration is said to be *bronchial.* The sound does not materially differ from that which is heard in health, near the root of the lungs. The sounds of inspiration and expiration, however, are for an obvious reason less distinct from each other and more continuous. The bronchial respiration may depend upon a consolidation of the pulmonary tissue, and an obliteration, temporary or permanent, of the air-cells. The air is admitted into the larger tubes, but not into the minute ramifications, or into the pulmonary vesicles. It is in consequence of the greater solidity of the intermediate structure, that the sound is conveyed to the surface. Sometimes the blowing sound is even louder than over the trachea, probably owing to the greatly increased surface of contact with the air, consequent upon the multiplication of the tubes; and also to the fact, that, in addition to the sound made by the movement of the air in the smaller tubes, that also of the larger tubes is brought to the ear, being conveyed downward through the ramifications, and thence to the surface through the solidified lung. The blowing character of respiration may also be induced by dilatation of the tubes, without condensation of the pulmonary tissue; but in this case the vesicular murmur is mixed with it. The strongest effect is produced by dilatation of the tubes, existing jointly with consolidation of the tissue. In violent dyspnœa, the bronchial respiration may sometimes be heard over the whole chest without any change of structure.

Bronchial respiration may be *diffused* equably over a considerable extent of lung, and proceed apparently from a great number of smaller tubes; or it may be *limited,* as if proceeding from the larger tubes only, the smaller ramifications being filled or consolidated along with the air-cells. In the latter case, the medium being denser, is a better conductor of the sound, which is therefore more distinct, louder, and of a metallic character, as if produced in a brass pipe. In this state, the respiration may be called *tubal* or *tubular.* Another modification is the *cavernous respiration,* produced by the passage of air into a cavity of moderate size. The sound is hollow, blowing, metallic, circumscribed, and less rapid than in the other varieties. When the cavity is very large, with dense and firm walls, the sound is still more metallic, and resembles that produced by blowing into an empty glass bottle. The respiration is in this case denominated *amphoric.* It is heard both in inspiration and expiration, unless the opening into the bronchia be very small, in which case the expiration is not distinctly audible. It is probably in this condition that the *amphoric sound* may become sensible through strong inspiration, when not heard in ordinary breathing. These sounds often pass into each other by such insensible gradations that no accurate line can be drawn between them; and the *cavernous respiration* is denied by Skoda to be in any degree distinct from the bronchial. It is certain that there are none of these sounds, except the amphoric, which may not be produced without a cavity in cases of consolidation of the pulmonary tissue; yet it is no less certain that, as a general rule, excavations in the lungs do give a somewhat modified character to the bronchial sound, which, though it cannot be relied on as sure evidence of a cavity, may, in conjunction with other not more certain signs, render its existence extremely probable. There does not, therefore, seem to be sufficient reason for abandoning, at least in the present state of our knowledge, the nomenclature of Laennec in this respect.

The morbid sounds hitherto treated of are modifications of those of health. But others of a distinct character are generated by disease, and are highly important as signs. These are called *rales* by the French, *ronchi* by English authors. I prefer the former word, as susceptible of being adopted into our language; while *ronchus*, with its plural *ronchi*, must always remain foreign to it. These rales may entirely supersede the healthy sounds of the chest, or may more or less mingle with and mask them. They result from the passage of air through altered tubes, or through liquid or semi-liquid matters contained in them, or from the friction of contiguous surfaces in the respiratory act. They have been divided into the dry and the moist. The *dry rales* are formed by the passage of the air, with more than the ordinary rapidity, through portions of the bronchial tubes, narrowed either by inflammatory thickening, adherent secretions, spasmodic contraction, or exterior pressure. The chief varieties of this sound are the *sibilant* and the *sonorous rales*. The *moist rales* are produced by the passage of air through a fluid in the bronchia of greater or less tenacity, causing the formation of a succession of bubbles, the bursting of which occasions the sound. They include the *mucous rale* and its varieties, the *crepitant*, and the *subcrepitant*. Each of these requires a brief description.

1. The *sibilant rale* is a low whistling sound, heard both in inspiration and expiration, or in either exclusively, sometimes short and sharp, ceasing almost immediately, sometimes prolonged and of a lower tone, and produced usually in the smaller bronchia, though it may occur in the larger when their caliber is very much diminished.

2. The *sonorous rale* is a *musical* sound, of a deep or grave tone, and has been compared, in its different varieties, to the snoring of a man, the humming of a gnat, the plaintive cooing of the wood-pigeon, and the bass notes of a violin. It varies greatly in intensity, being in one extreme so low as to be just audible, and in the other so loud that it may be heard at some distance from the chest, without the aid of an instrument. It may occur during either inspiration or expiration, or may accompany both these movements, but is more common in the latter. It is sometimes of short duration, in consequence of the sudden removal by coughing or otherwise of the obstructing cause, sometimes persistent, though generally occurring interruptedly, and seldom with every successive respiratory movement. It arises in the larger bronchial tubes, which alone are capable of producing the grave tone by which it is characterized. It is occasionally associated with the sibilant and mucous rales. A modification of this sound, sometimes called the *dry mucous rale*, is produced by a portion of tough mucus obstructing a tube, and yielding to the air, during each inspiration, at short, successive intervals, so as to occasion a ticking or crackling noise, which, during very rapid and forcible breathing, becomes continuous, and passes into the proper sonorous rale.

3. The *mucous rale* is heard in bronchial tubes of the size of a crow's quill or larger, and is formed by the bursting of bubbles of liquid, whether

mucus, pus, or blood, of considerable, but unequal size. It accompanies both inspiration and expiration. When prevalent over a considerable portion of the lungs, it may often be heard at some distance from the chest. It is familiar to most practitioners, as the sound which attends bronchitis after secretion has become established; and, in the stage of transition from the dry to the secretory state of the membrane, is often mixed with the sibilant and sonorous rales, forming a singular combination of sounds, which have been compared to the various notes of different birds, singing or chirping together. In the smaller tubes, in which the bubbles are necessarily more minute, and the sound weaker, it is sometimes designated as the *submucous rale*, an example of which is afforded in the early stage of pulmonary tubercles, which keep up a slight inflammation in the small tubes in their vicinity. When the air passes into a pulmonary cavity, or into morbidly enlarged bronchial tubes containing liquid, the sound is still looser and coarser than the mucous rale, assuming a gurgling and sometimes hollow character, which has entitled it to the name of *cavernous rale*. This is usually more circumscribed, and confined to narrower limits than the mucous rale, though, when owing to enlarged bronchia, it may extend over a considerable portion of the chest.

4. The *crepitant rale* is a very fine, regular, crackling sound, with minute, sharp, equal crepitations, and resembles very closely that made by rubbing a lock of hair between the thumb and fingers, near the ear. It has been compared also to the crackling of salt, and to that produced by the burning of a very small train of moist gunpowder. It is confined exclusively to the minutest bronchial tubes, and to the air-cells, and may depend on the successive bursting of very minute bubbles of the tenacious secretion which occurs in pneumonia, of which affection this sound is characteristic, or, as suggested by Dr. Carr, of Canandaigua, New York, upon the separation of the walls of the cells, agglutinated by the plastic exudation. (*Am. Journ. of Med. Sci.*, N. S., iv. 360.) One of its peculiarities is, that it is heard only during inspiration, and this fact corresponds with the explanation of Dr. Carr, as it is only during the expansion of the air-cell that the necessary condition for its production exists. Or, the peculiarity may be owing to the passage, which has been opened by the entering air, remaining open for a time, in consequence of the stiffness of the secretion, and permitting the returning air to escape without resistance, and consequently without sound. When this rale is once perceived, it remains for a considerable time, and is not removable, like the mucous rale, by coughing, and thus clearing out the bronchia. Two varieties of the crepitant rale may be distinguished, one fine as above, the other coarser, more irregular, and often heard in expiration. The latter approaches to the subcrepitant.

5. The *subcrepitant rale* is intermediate between the two preceding. The sound is bubbling, but the bubbles are finer, more crackling, and more regular than the mucous. It has been compared to the sound of a liquid in moderate effervescence. It is heard both in inspiration and expiration.

Variations in the force and fulness of respiration materially affect the sounds above described. Some that are heard in ordinary breathing, cease when the lungs are fully expanded, because the passage for the air is now free. On the contrary, when the bronchial fluids are so abundant as to close the smaller tubes, and thus entirely to prevent the passage of air, a forcible and deep inspiration will open them, and thus enable the respiratory sounds to be generated. Sometimes the different sounds are audible at the same time in different parts of the lungs, and two or more occasionally in the same part. Not unfrequently also the rales are combined in greater or less proportion with the healthy respiratory sounds; and very often much experience and a patient examination are necessary, to enable the practitioner to distinguish them satisfactorily.

It must be recollected that, in consolidation of the pulmonary tissue, the various rales above referred to may be heard, in like manner with the bronchial respiration, in parts of the lungs distant from their point of production, being conveyed through the bronchial tubes into the consolidated lung, and through that to the ear.

Metallic tinkling is another morbid sound requiring notice. It is quick and sharp, and resembles that produced by striking a pin, or other small metallic body, gently against a glass vessel. Different opinions have been held as to its cause. The only necessary condition of parts, universally admitted, is the existence of a cavity of considerable size, with firm walls, containing air. Laennec supposed the simultaneous presence of air and a liquid in the cavity essential to its production. It has been ascribed to the passage of a bubble of air through the liquid, to the bursting of the bubble on the surface of the liquid, and to the falling of a drop of fluid matter from the walls of the cavity, through the air, into the liquid. But Dr. Williams is probably correct in considering it as resulting from any sudden vibration of the air in the cavity, which is reflected from side to side of the walls. Hence, not only may any one of the above causes occasion it, but the voice, the respiratory act, and the different rales, may have the same effect; nor is the conjoined presence of air and liquid absolutely necessary, as it has been produced in cavities filled only by air, and having no external communication, by the mere concussion of the voice and cough carried through condensed pulmonary tissue. (*Tweedie's Syst. of Pract. Med., art. Pneumothorax.*) In pulmonary cavities, having an external communication, it frequently attends and alternates with amphoric respiration, which owes its existence to a similar condition of parts. A sufficiently correct idea of the sound may be obtained by ausculting over the stomach, when it contains a certain amount of air and liquid; and an analogous sound is produced by placing the palm of the hand over the ear, and then giving the back of it a sharp tap with the end of the finger.

Friction sound is a name given to the noise produced by the rubbing together, during respiration, of the pulmonary and costal pleura, roughened by an irregular deposition of coagulable lymph upon the surface. It is of course entirely morbid, never being produced in a healthy state of the membrane. It consists usually of a succession of quick, jerking sounds, not very numerous, superficial in position, developed over an uncertain but limited extent of surface, and exceedingly variable in intensity, being sometimes scarcely audible, sometimes very loud, and, in the latter case, often attended with vibrations of the walls of the chest, perceptible to the hand, and even felt by the patient himself. Sometimes the friction sound, when not occasioned by ordinary breathing, may be developed by a deep inspiration, or by coughing. In its slighter varieties, it sometimes closely resembles the subcrepitant rale, from which it may be distinguished, according to Dr. Gerhard, by less regularity in the component sounds, and by not following so closely the passage of the air. Though usually most observable during inspiration, it is generally heard during both movements, but rarely, if ever, according to Walshe, in expiration alone.

The friction sound is not confined to the pleura during respiration; but is produced by whatever causes two contiguous surfaces of a serous membrane to move upon each other, when roughened by the exudation of coagulable lymph. It sometimes arises from the movements in the inflamed pleura, occasioned by the contraction and dilatation of the heart; and may be clearly perceived over the abdomen, in cases of peritoneal inflammation with plastic effusion, when the walls are made to move upon one of the solid viscera, or upon an abnormal tumour, as during a deep inspiration, or by a change of position.

Under the same name may be included the *creaking sound* made by the movement, during respiration or the pulsations of the heart, of the consolidated layer of coagulated lymph, after adhesion between the opposite surfaces has taken place. It is obvious that the proper interrupted friction sound may pass by degrees into the more continuous creaking sound, as the surfaces gradually coalesce.

The friction sound is attended with vibrations of the thoracic walls, which may generally be perceived by the hand; and sometimes are sensible to the patient himself.

The *vocal resonance* is also a subject of auscultation. This obviously includes cough; for all sound formed in the larynx, above that of the breath, is voice, whether articulated or not. It will be most convenient, as in the respiratory sounds, to treat first of the healthy sounds, and afterwards of their modification by disease. If the stethoscope be applied over the trachea, in front of the neck, or at the top of the sternum, the voice will be heard loudly, and words will reach the ear through the tube with tolerable distinctness. This sound is sometimes called *tracheophony*. For a short distance on each side of the upper part of the sternum, below the clavicle, between the scapulæ behind, and in the axilla, the voice is still heard, but less loud and distinct, and with a very imperfect and confused articulation. The sound is, in these situations, called *bronchophony*. It does not extend below the third rib in front. Over the remainder of the lungs, the voice is either not heard, or produces only an obscure, confused, thrilling sound, which may be distinguished by the name of *pectoral resonance*, and is often accompanied with a slight vibration of the walls of the chest, sensible to the hand laid flatly against them. The cause of this difference is, that, in the former case, little besides the walls of the chest intervenes between the bronchia and the ear, while, in the latter, the tubes are enveloped in a mass of spongy pulmonary tissue, that intercepts the sound, which, moreover, is weakened by its ramification with the air-passages. The bronchial sound is a little stronger on the right side than on the left, below the clavicle, and in the space between the spines of the scapulæ behind. In other parts, allowance being made for the heart, the two sides of the chest have a pretty accurate correspondence. The general vocal resonance is stronger in the upper than in the lower portions of the chest, and in front than behind, except in the interscapular space. It differs greatly in different individuals. A thin chest transmits the sound better than one which is fat, or very muscular; and a voice with a high key penetrates more deeply into the lungs than a low or bass one, in consequence of the more ready entrance of its small vibrations into the smaller tubes. But, as the bass voice is usually the strongest, it is more apt to produce a general vibration of the chest. Hence, the pectoral resonance and sensible tremor of the walls of the thorax are more marked in men; while articulate sounds extend further in women and children. The difference between individuals, in relation to the degree and extent of these sounds, is so great, that pathological inferences are deduced, less from their general character in any particular case, than from their want of correspondence on opposite sides of the chest.

The vocal resonance may be morbidly diminished or suppressed, in consequence of collapse of the lung, or the intervention of a badly conducting medium, as of a large quantity of liquid in the pleural cavity. It is, however, much more frequently increased, often becoming, in diseased lungs, much louder and more extensive than in health; so that, in parts of the chest where naturally only a feeble sound is heard, it may approach or equal that ordinarily perceived over the larger bronchia or the trachea.

When bronchophony is perceptible in other parts of the chest, besides those above pointed out as the seat of it in health, it is in general a sign of disease. It usually results from the intervention of a denser medium than the normal structure of the lungs between the bronchia and the ear, and may indicate either consolidation or compression of the lungs, or effusion of liquid into the air-cells, the interlobular tissue, or to a certain extent into the pleural cavity. It may also depend upon morbid enlargement of the bronchial tubes, with thickening and consolidation of their walls. It is a valuable sign in diagnosis; but the fact before referred to must be borne in mind, that persons differ much in the degree to which it naturally prevails, and that it may be audible in one individual without deviation from health, in parts in which it would in others be unquestionably morbid. To obtain correct inferences, therefore, it is proper to examine both sides of the chest; and, if the sound be louder on one side than at the corresponding spot on the other, or if it be heard only on one side, allowance being made for the naturally greater resonance at the top of the right than of the left lung, the presumption will be strong of the existence of disease.*

Ægophony is a name given to a modification of bronchophony, supposed to be produced by the intervention of a moderate layer of liquid between the side of the chest and the lung. The voice, transmitted through the compressed lung to the liquid, imparts to this a vibratory movement, which causes the sound as it passes to the ear to assume a tremulous irregular character, compared to the bleating of a goat, from which this variety of bronchophony derived its name. When the lung is at the same time consolidated, the resonance is louder than when dependent solely on the presence of effused liquid. But the same sound is sometimes produced without liquid in the pleural cavity, and Skoda asserts that it is occasionally heard in the healthy lung, in the interscapular space. It cannot, therefore, depend solely on the movement of the liquid, as supposed by Laennec. Skoda ascribes it to the impact of one solid body against another, or of a solid against a liquid or aëriform body.

Pectoriloquy is another variety of morbid vocal resonance, in which not only the sounds of the voice, but the articulated words seem to proceed from the walls of the chest directly into the ear, resembling tracheophony almost exactly. It differs from bronchophony in the distinctness of the articulation, and in the circumstance that the resonance is usually more circumscribed, and limited in its extent. It is produced by the voice entering a cavity which communicates freely with the bronchial tubes. When the cavity is near the walls of the chest, the voice is still louder and more distinct. But it may also be produced in the bronchial tubes of solidified lung tissue without a cavity, of which, therefore, though it may in general indicate the existence, it cannot be considered as a pathognomonic sign.

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* Skoda, the celebrated professor of Vienna, denies that the bronchial sound is conveyed more readily through consolidated pulmonary tissue than through the same tissue in a healthy state. He ascribes the sound heard under such circumstances to *consonance*, by which the vibrations produced by the voice in the larynx, and conveyed through the air of the bronchial tubes, are repeated by the walls of those tubes in the consolidated lung, and thence reach the ear; the only effect of the consolidation being to give increased firmness to the walls of the bronchia, and thus enable them to vibrate more freely. He extends the same views to the respiratory bronchial sound, which he believes to be formed not in the tubes of the solidified lung, which scarcely expand or contract in respiration, and into which, therefore, air does not enter, or enters only in small quantity, but in the larger bronchia above, from which it is conveyed downward through the contained air. Skoda is no doubt correct in ascribing both bronchophony and morbid bronchial respiration to a conveyance of the sound from above into the tubes of the diseased lung; but he has not proved that the walls of the tubes do not transmit the vibrations as well as the contained air, nor that these vibrations do not reach the surface more readily through the solidified lung than they would do through the healthy sponge-like tissue. It is an established law in physics that solids transmit vibrations more readily than air, as in the well known example of a rail, in which a slight scratch of a pin at one end is distinctly heard at the other. Is it probable that a piece of loose sponge would transmit vibrations producing sounds so readily as the same sponge infiltrated with wax? A similar relation the healthy pulmonary tissue bears to the same tissue uniformly consolidated by plastic exudation.—(*Note to the fourth edition.*)

Amphoric resonance is the sound produced by the voice in a large cavity communicating with the bronchia by a small aperture. In this case, the voice is not articulated as in pectoriloquy, and does not seem to enter the ear as in bronchophony, but reverberates through the cavity, and has a ringing metallic sound, similar to that produced by speaking into a hollow broad-mouthed vessel.

The cough, which in health yields to auscultation a short, dull, indistinct sound, undergoes, in morbid states of the lungs, modifications analogous to those produced upon the ordinary voice. It is called *bronchial* under circumstances which produce bronchophony, *cavernous* under those which produce pectoriloquy, and *amphoric* in large cavities with firm walls and narrow outlets.

The signs of respiration and vocal resonance generally correspond, as they result from the same physical modifications of structure. Thus, rough respiration and increased resonance, bronchial respiration and bronchophony, cavernous respiration and pectoriloquy, and finally amphoric respiration and amphoric resonance usually go together, and lend to each other a mutual support, as means of diagnosis.*

As a general rule, all the sounds given forth in morbid states of the respiratory organs are heard in those parts of the walls of the chest which correspond most nearly with the part affected; but it is necessary to bear in mind, in order to avoid false inferences, that they are sometimes conveyed to a considerable distance from their true seat, by the intervention of abnormal solid or liquid matters, which have a greater conducting power than the healthy pulmonary tissue. Thus, gurgling from a cavity in the upper part of the lung may sometimes be heard low down in the organ when solidified; and cardiac murmurs, usually most distinct at points nearest the valves producing them, are, under similar circumstances, sometimes audible over large portions of the chest.

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* The voice of the operator, in auscultation, may be used as a means of diagnosis. When a person, with his ear applied to the chest, speaks aloud, the tone of voice varies according to the condition of the parts beneath, being lower or more bass with greater resonance when the lung is solidified, as by tubercles or by inflammation, than when in the healthy state; higher or shriller, and also more resonant, when there is a large cavity filled with air; and quite flat, and without resonance, when the lung is compressed, as by pleuritic or dropsical effusion. Now it must be obvious that a person who has rendered himself familiar with the effects of these and other conditions of the chest upon his own voice, will be able to detect them with some certainty by simply speaking aloud in the act of auscultation. The name of "*heautophonics*" had been proposed by Dr. R. G. Latham, for this mode of diagnosis; and some attempts have been made by Mr. G. Corfe, of the Middlesex Hospital, to apply it to the study of particular pectoral affections. It is scarcely probable, however, that sufficient precision can be given to rules upon the subject, to render it anything more than a subordinate aid to ordinary auscultation. (See *Braithwaite's Retrospect*, xvii. 65; from *Med. Times* for January and March, 1848.)—*Note to the second edition.*

rate, the practitioner should seize the same point in successive inspirations or expirations, for his trials. Care should also be taken that the finger, or other object employed as the pleximeter, should be in the same direction, and upon the same structure on the opposite sides; that it should not, for example, be in the intercostal space upon one side, and on the rib upon the other, or in a perpendicular direction on one, and a horizontal on the other.

In order to appreciate the morbid changes of the pectoral sounds, it is necessary to be acquainted with their modifications in the healthy chest. The results of percussion vary considerably in different individuals, in consequence of difference in the relative size of the lungs, and the relative magnitude and position of the neighbouring viscera. The following probably approaches, as nearly as may be, to the general average. In the whole upper portion of the chest, anteriorly and laterally, the sound has the ordinary pulmonary character, and does not differ materially on the two sides. As we descend, the sound is modified by the presence of the liver upon the right side and in front, by the heart and stomach in front and on the left side, and by the spleen further to the left. Over the liver, heart, and spleen, the sound becomes duller, shorter, and flatter; over the stomach either very flat, when that organ is full of food, or very resonant, and of a peculiar tympanitic character, when it contains only air and a portion of liquid. But the change of the sound from the pulmonary character to that of the organs above mentioned is not abrupt. In consequence of the convexity of the diaphragm, the abdominal viscera project further into the thorax towards the middle than at the edges of the cavity, where they are to a considerable extent overlapped by the lungs; and the thickness of the pulmonary layer, intervening between them and the walls of the chest, diminishes gradually in the downward direction until the lung ceases, and the viscera press directly against the ribs. In like manner, the lung overlaps the greater portion of the heart, with a gradually diminishing thickness as it approaches the uncovered part of that organ. It follows that the clearness of the pulmonary sound gradually diminishes from the outer limits of the heart, liver, and spleen, up to the line where the lung ceases, when it yields entirely to the flat sound afforded by these organs; while, in the transition to the stomach, it changes into the strikingly different resonance of that organ if flatulent, or into its perfect dulness if full. On the right side, the sound begins to become somewhat duller below the fourth rib in front, and the sixth rib in the side, and gradually increases in dulness as far as the sixth rib in front, and the eighth in the side, below which the pulmonary is superseded by the hepatic, and, to a certain extent, towards the epigastrium, by the stomachic sound. Behind the middle of the sternum, and on the left side behind the third rib in front, a very slight diminution of clearness may be observed, in consequence of the presence of the heart, which is here, however, covered by the lung. Behind the intercostal space between the fourth and fifth ribs, for an extent of one or two square inches, bounded by the middle of the sternum on the right, and stretching towards the nipple on the left, which, however, it does not reach, there is dulness in consequence of the contact of the heart with the chest. With this exception, the left lung reaches to the seventh rib in front, and to the eighth on the side, where the pulmonary gives place to the stomachic, and perhaps slightly in front to the hepatic sound, and further towards the left to the splenic. Besides these variations anteriorly, there are others in the upper part of the chest. The sternal extremity of the clavicle gives a very clear sound, which becomes somewhat duller towards the middle of the bone, and is much duller at the humeral extremity. Above the clavicle percussion is less resonant than below; and the sound on the right side under the clavicle is said by Dr. Gerhard to be in a slight degree less clear than on the left. In the back of the chest, the sound is much affected by the masses of muscle, and the presence of the scapula. It is very dull above the spine of the scapula, somewhat less so upon that bone beneath the spine, and still less so upon the spinous processes of the vertebræ. In the space between the scapula and spinal column it is rather clear, but is clearest below the scapula, until we reach the region of the liver on the right side, and that of the stomach or colon and spleen on the left, which is somewhat lower than the same line anteriorly. This infra-scapular region is peculiarly clear in children. The sound is remarkably clear in the lateral portions of the chest in consequence of the absence of muscle. The pulmonary sound generally is clearer in children than in adults, and in these than in old persons. In women it is affected in front by the mammæ, which render it dull, unless under pretty strong percussion.

But the limits above designated are much affected by a full inspiration, which causes the lung to descend about one rib lower, and almost entirely to cover the surface of the heart; so that the boundary of the proper pulmonary sound is thus much extended, while the sound itself becomes clearer. A full expiration, on the contrary, somewhat narrows its limits, and extends those of dulness, at the same time diminishing somewhat the general clearness of the sound. But it has been observed by Williams that either a full expiration or inspiration, by giving greater firmness to the walls of the chest, quickens their vibrations, and renders the key higher. It must be recollected, too, that the degree of clearness in those parts of the chest where the lungs overlap the heart, liver, &c., depends in some measure on the force of percussion; a slight impulse evolving only the sound proper to the superficial parts, and consequently a clear one, while a strong impulse brings the hepatic and cardiac dulness to the surface. The limits between the lungs and stomach cannot be so easily detected, in consequence of the hollow resonance of the latter organ, which swallows up the slighter pulmonary sound, though a very feeble percussion may sometimes elicit the latter, without the former.

The morbid states revealed by percussion are those in which the pulmonary sound becomes flatter, or is altogether superseded, and those in which it acquires additional clearness and sonorousness. The former effect is produced by whatever increases the density of the pulmonary tissue, or substitutes a denser substance in its place; the latter, by whatever increases the relative amount of air, whether in the air-cells, in morbid cavities, in the cavity of the pleura, or in the external cellular tissue. The special changes of the sound will be more conveniently treated of under the several affections upon which they depend, and which they serve to indicate. It will be sufficient here to state that percussion is said to be *tympanitic* when it produces a drum-like sound, as over a cavity containing air with moderately tense walls; *tubular* when made over the trachea or one of the larger bronchia with solid or liquid intervening between it and the wall of the chest; and *amphoric* when attended with a certain musical intonation similar to that of amphoric resonance and respiration, and usually indicative of a large cavity with firm and thin walls, and lying near the surface. Consolidation or hepatization of portions of the lungs, œdema of these organs, compression by fluids in the pleural cavities, solid tumours, encroachments of the neighbouring organs, as the heart, liver, stomach, and spleen, emphysematous distension of the air-cells, and the presence of air within the pleura, are among the pathological conditions which percussion may assist in pointing out. But it is inadequate to the detection of very slight changes, especially if deeply seated, and it seldom happens that it is alone sufficient precisely to define the character of the complaint. It is highly important, however, by calling attention to the existence of disease within the chest, and, in connexion with other methods of diagnosis, often serves to give a certainty scarcely attainable otherwise. In relation to the existence of fluid in the pleural cavity, it is often of itself sufficiently diagnostic. If dulness upon percussion is observed in the lower part of the chest, and if this dulness materially varies with the position of the patient, being absent or present according as the operation of gravity ought, in the change of position, to bring the level of the surface of a fluid in the pleura below or above the point of examination, the evidence is conclusive that such a fluid exists in the cavity. An important fact, ascertained by Skoda, is, that great tension of the walls of a cavity containing air, contrary to what was formerly believed, causes dulness on percussion. This is probably owing to a degree of immovability of the particles, which prevents the ready transmission of vibrations to or from the air beneath; so that it is only the sound of the surface percussed, and not that of the air which is heard.

Independently of the diversities of sound evolved by percussion, this method also affords useful indications by the impression made upon the sense of touch. When percussion is made with the finger, a certain sense of *resistance* is perceived, the degrees of which serve as a measure, in some degree, of the condition, in relation to elasticity, of the parts percussed; and inferences can thus be drawn as to the condition of the lungs, which may serve to confirm or correct, in some instances, those deducible from the sound.

Inspection.

This is nothing more than an examination by the eye of the shape, size, and movements of the chest; and the object is to ascertain the existence of any deviations from health, in either of these respects. The patient should be viewed in front, behind, in the direction of his length, and from side to side. During the inspection, the chest should be naked, or, as in females, covered with a thin closely fitting garment; and the position of the body should be in one uniform plane, whether lying, sitting, or standing. In order that a good longitudinal view may be obtained, the patient may lie evenly on his back, while the practitioner stations himself at the foot of the bed, and directs his eye along the surface of the chest; or, what is perhaps better, the patient may sit, and the practitioner, standing behind him, may bend over his shoulder and look from above downward.

In a perfectly well-formed chest, the sides are symmetrical. The general shape of the chest is that of an irregular cone, truncated at top, larger below than above and from side to side than from front to back, somewhat depressed above the clavicle, rather less so immediately below it, and gently convex from the second rib downward, as far as the base of the lungs, where a slight depression or flatness may often be observed surrounding the chest, immediately above the bulging produced by the abdominal viscera, during inspiration. Attention has been called by Dr. Edward Harrison to this line of depression, as the boundary between the lungs above, and the liver, stomach, and spleen below. The chest is often slightly prominent over the heart. Behind, it is somewhat convex from above downward, and there is a sulcus on each side of the spine. The ribs, except in fat persons, are somewhat more prominent than the intercostal spaces. But a perfectly formed chest is rare. Derangements, either congential or acquired, are very common, without any want of health in the contents of the thorax. This must always be taken into consideration in forming a judgment; and it will seldom be proper to depend on the shape of the chest, without confirmatory evidence from other signs. But this is valuable as an aid in diagnosis; and, when any considerable deviation posite surfaces of the inflamed pleura may sometimes be perceived by the hand, as may also the vibrations which attend a sonorous rale of great intensity. In the same way, fluctuation in the pleura or lungs may occasionally be detected; the fluctuating movement being produced either by strong agitation of the chest in certain morbid states of respiration, or artificially by shaking the patient, or by a sharp tap with the fingers upon one of the intercostal spaces in the neighbourhood. The act of respiration also gives rise to it, in cases of large pulmonary cavities partly filled with liquid. In examining the chest in reference to these parietal vibrations, it is generally proper to apply the two hands to corresponding portions of the opposite sides, so that the effect produced may be compared. If found less or greater upon one side than the other, it gives ground for reasonable suspicion of disease. The application of the hand sometimes aids in the detection of a want of correspondence in the movements of the opposite sides of the chest, and even of different parts of the same side. The immobility of a portion of the walls of the chest, thus detected, may become under some circumstances a valuable sign.

The beating of the heart, after full expiration, is felt between the cartilages of the third and fifth ribs, and at the neighbouring part of the sternum. After full inspiration, it is either quite lost, or felt as low as the sixth rib. When the lungs are extensively consolidated, even though the heart itself may be healthy, the impulse is sometimes felt to a considerable distance.

Measurement.

The modes of effecting measurement have been elsewhere described. (See *page* 204.) The object of the process is to detect differences in the dimensions of the two sides, or in those of the whole chest at different times. It should be recollected that the right side of the chest is usually rather larger than the left, owing probably to the greater developement produced in the whole of that side by exercise, though the liver may also have some effect in causing the difference. The amount of difference varies with the degree in which the causes operate. On the average it is about half an inch. In left-handed persons it is said that the two sides are equal, or that the left is somewhat larger. Care must be taken, in making comparative measurements, that the lungs should be in the same condition in reference to the respiratory movement; and, therefore, it may be best that the patient should hold his breath during the examination. Among other points ascertained by measurement, is the increase or diminution of fluids in the cavity of the pleura.

Under this head may also be considered the measurement of the respiratory movements, and of the quantity of air respired. It is often desirable to know how, and to what extent, the motions of the thorax and abdomen are interfered with by disease; and diagnosis is aided, in several important points, by the decision of this question. In order, however, to have some standard of comparison, it is necessary to determine the mean amount of movement in health. In ordinary respiration in men, the walls of the chest are but slightly expanded; inspiration being mainly effected by the descent of the diaphragm. The forward movement of the chest, therefore, is very slight, while that of the abdominal parietes is considerable, and readily observable by the eye. In women, it is different; the thoracic movement being much more distinctly observable, and that of the abdomen less so. According to Dr. Sibson, the forward movement of the sternum, above the seventh rib, in a robust man, in ordinary healthy respiration, is from the fifteenth to the fourteenth of an inch, that of the abdomen about one quarter of an inch. In forced respiration, these dimensions are greatly altered. An extreme inspiration will advance the sternum from one to two inches; while the greatest movement of the abdomen is from half an inch to an inch and a half. In the fullest possible inspiration the abdomen projects very little, because the expansion is now effected mainly by the ribs, and comparatively little by the descent of the diaphragm. The expansion of the chest, as indicated by its circumference, in a healthy male adult, at the level of the sixth cartilage, in an ordinary inspiration during calm breathing, is on the average about one quarter of an inch. In a forced inspiration it amounts to from one and a half to three inches, being somewhat greater on the right than the left side. The difference between the extremes of a forced inspiration and a forced expiration, varies from two and a half to five inches. In the abdomen, in the greatest possible inspiration, the increase is only about one quarter of an inch, being less than that which occurs in ordinary breathing; though, by a voluntary effort of the individual, directing the inspiratory movement rather to the diaphragm than the ribs, the result may be very different. Any considerable deviation from the above measurements may be looked upon as suspicious, and should lead to further investigation. Two instruments have been invented, which greatly facilitate the mensuration of the chest while in motion. One of these is the "chest measurer," of Dr. Sibson, the other the "stethometer," of Dr. Quain, the former of which indicates the change of diameter, the latter that of circumference.* In relation to the measurement of the quantity of air respired, it is extremely difficult to arrive at any satisfactory results; and the reports of different experimenters have been so various and conflicting, that little reliance can be placed on them for practical purposes. An instrument, however, invented by Mr. Hutchinson, affords a very convenient method of measuring the amount of expired air; and some conclusions have been attained by means of it, which are not without practical value. An account of this instrument, which is called the "spirometer," and of its application, is given in a note below.†

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* The "chest measurer," of Dr. Sibson, consists of a small round case with two dial-plates supported at the end of a rod, which at the other end is connected, in a manner to admit of free movement upward and circularly, with a second rod rising perpendicularly from a long narrow plate, upon which the body rests when examined. From the interior of the case projects a short movable rack, which, as it rises or falls, causes the index hand on the face of the dial to revolve in a circle, each revolution representing an inch of movement in the rack, and each subdivision the hundredth of an inch. When applied, the end of the rack is brought into contact with the surface of the chest or abdomen, the elevation or depression of which, at the point of application, is exactly measured by the movement of the rack, and, of course, by the change of the index on the dial. For a particular account of the instrument and its uses, the reader is referred to Dr. Sibson's paper, in the *London Medico-Chirurgical Transactions* (xxxi. 355).

The *stethometer* of Dr. Quain is a simpler instrument. Upon the surface of a case resembling a watch, is a graduated dial with an index, moved by means of a silk cord a foot or more in length, that enters the side of the case. The instrument being applied by the fingers of one hand to any given point of the chest, the cord is carried over that part of the surface the movements of which are to be measured, or, if deemed advisable, quite round the thorax, and, being fixed by the other hand, acts with each expansion or elevation of the thoracic wall upon the index, a complete revolution of which indicates an extension of the cord, and consequently an increase in that part of the circumference measured, equal to one-fourth of an inch. The instrument and its uses are particularly described in the *London Medical Gazette* for January, 1851 (page 127), and in *Braithwaite's Retrospect* (Am. ed., xxii. 157). *Note to the third edition.*

† Mr. Hutchinson's *spirometer*, as modified by Dr. Pereira, consists essentially of a reservoir of water, in which is suspended an inverted glass receiver, so arranged that, by breathing through a tube entering into the receiver from below, this is made to rise in proportion to the amount of air admitted, which is measured by a graduated scale affixed to the upper end of the receiver. As each degree of the scale represents a cubic

SUBSECTION I.

INFLAMMATION OF THE RESPIRATORY PASSAGES.

Inflammation may occupy distinct portions of these passages, terminating in the same part in which it began, or it may affect several portions successively or simultaneously, forming one continuous disease. Thus, we have inflammation of the nostrils, of the larynx, of the trachea, and of the bronchial

inch, it follows that the number of degrees through which the receiver rises indicate the number of cubic inches of air expired.

From the various circumstances which modify respiration, it is almost impossible to measure with accuracy the results of that process as ordinarily performed. But the greatest amount of air that an individual can possibly expire, after the fullest possible inspiration, gives a certain measure of capacity which can be ascertained, and, being compared as found in the same individual under different circumstances, or in different individuals as nearly as may be under the same circumstances, may lead to inferences of some practical value. To this quantity Mr. Hutchinson gives the name of "*vital capacity.*" Now, from the examination of a vast number of individuals, Mr. Hutchinson seems to have established the curious law, that the vital capacity is proportionate in health directly to the height of the body, without reference to the depth or breadth of the chest, or to its absolute capacity when at rest. It is, however, somewhat affected by the weight and the age of the individual, and allowance must be made for these modifying influences in forming any practical conclusions. Other influences also are not without effect; but they may be left out of the calculation with little inconvenience.

The mean vital capacity for a man from five feet to five feet two inches, at a temperature of 60°, was found to be 175 to 176 cubic inches. For convenience of calculation it may be stated at 174 cubic inches for the stature of five feet. For every inch of increased height, eight cubic inches are to be added to the vital capacity.

In reference to the effect of weight, it has been ascertained that the vital capacity in healthy men is not materially altered below the mean weight; but is diminished in a certain ratio with any increase amounting to more than 7 per cent. above the mean. The mean weight of a man in England, from five feet to five feet one inch in height, is said to be about 115 pounds. For every additional inch of height, the mean increase of weight may be stated roughly at 5½ pounds. From these data the mean weight for any height above five feet may be readily ascertained. Add to this weight 7 per cent.; and then, for every additional pound, one cubic inch is to be deducted from the vital capacity. These are only approximations to the numbers which have resulted from positive experiments as presented by Mr. Hutchinson; but they are sufficiently near for practical purposes, and are useful on the score of simplicity of calculation.

The effect of age is next to be considered. Up to 35 years, the vital capacity, according to the table of Mr. Hutchinson, is somewhat augmented with age, but not sufficiently so to render the increase an object of consideration. From 35 years to 65 there is a decrease of 45 cubic inches, or exactly 1½ cubic inches for every year. In estimating the vital capacity, therefore, this number must be deducted for every year above 35.

With these data, the normal vital capacity of any individual may be readily estimated; and, if this considerably exceed the result given by the instrument, the inference drawn would be unfavourable as to the healthy condition of his respiratory function. General debility, muscular fatigue, rheumatism or other disease of the respiratory muscles, and various abdominal affections, as well as disease of the lungs, have the effect of lowering this capacity; and the decision as to the precise cause must be left to other modes of investigation. It is obvious that the spirometer affords an admirable means of estimating any change in the capacity of the lungs of the same individual whether for better or for worse.

To illustrate the operation of the above rules let a case be imagined, and the result deduced in accordance with them. What is the healthy vital capacity of a man five feet ten inches high, weighing 160 pounds, and 45 years of age? Starting from 174 cubic inches, which is the vital capacity for the height of five feet one inch, and adding 8 cubic inches for each inch of stature, we shall have 246 cubic inches as the vital capacity in reference to the stature alone. The mean weight at five feet one inch is 115 pounds, to which 5½ pounds being added for every inch, gives the mean weight at 164½ pounds, or less than 7 per cent. beyond the supposed weight. No allowance, therefore, tubes, constituting severally coryza, laryngitis, tracheitis, and bronchitis, and inflammation of all these parts successively or conjointly, as in catarrh. It will be most convenient to consider the first set of these complaints in the first place; and, after the more local affections have been described, then to treat of such as embrace various parts of the structure, either at once or during their course.

Article I.

INFLAMMATION OF THE NOSTRILS.

In the nostrils we consider as included the neighbouring sinuses, as those of the superior maxillary and frontal bones, all of which are lined by continuations of the same mucous membrane, and all are liable to become inflamed, though the whole surface is probably seldom affected at once.

1. ACUTE INFLAMMATION OF THE NOSTRILS, or CORYZA.

Syn.—Cold in the Head.—Gravedo.

Symptoms.—The first sensations are usually those of dryness, fulness, and tickling or other irritation in the nostrils, with sneezing. These are in general soon followed by a copious discharge of a thin, colourless, acrid fluid, which still further irritates the membrane, while it often inflames and even excoriates the skin about the nasal orifices, and on the upper lip. The nostrils are at this time not unfrequently either partially or wholly closed by the tumefaction of the inflamed membrane, which causes the voice to assume a nasal tone. There is often a considerable degree of dull pain or aching, with burning heat in the nasal passages; and now and then severe stinging sensations are experienced from the irritation of the acrid fluid. The eyes become red and watery, either from sympathy, or by the continuous extension of irritation along the lachrymal passages; and sometimes these passages appear to be closed, so as to occasion an overflow of the tears. A similar extension of the disease to the frontal sinuses produces pain in the forehead. The maxillary sinuses are sometimes involved, with consequent pains in the face; and hardness of hearing in a greater or less degree is not uncommon, from swelling and closure of the Eustachian tubes. Even the external parts occasionally participate in the inflammation, and the nose and cheeks are swollen and tender. The sense of smell, and in a less degree that of taste, are almost always blunted or lost.

In many instances, the constitution does not seem to sympathize with the local affection; the pulse and skin remaining in their ordinary state, and the appetite unimpaired. Very frequently, however, febrile symptoms make their appearance, especially when the inflammation is of a high grade, and affects

is to be made on this score. The age being 10 years beyond the standard of 35, and 1½ cubic inches being the mean diminution for each year, 15 altogether are to be deducted from the 246 cubic inches, which represent the vital capacity in reference to height alone. There will then remain 231 cubic inches as the healthy vital capacity under the circumstances referred to, and as that which the spirometer should indicate. (See, for Mr. Hutchinson's paper, *London Medico-Chirurgical Transactions*, xxix. 157.) In using the spirometer, with the view of ascertaining the vital capacity, the individual should loosen his dress, stand erect, and then, having inspired to the utmost extent of his power, apply his mouth to the tube, and empty his chest as completely as possible into the receiver. (*Note to the third edition.*)

the whole of the nasal passages. Chilliness and pains in the limbs are followed by a hot skin, excited pulse, furred tongue, loss of appetite, and severe headache. The fever sometimes shows a tendency to exacerbations and remissions.

The complaint usually attains its height in three or four days, after which the symptoms begin to subside. The uneasiness in the nostrils and adjoining parts diminishes; the secretion becomes less copious, thicker, more opaque, and less acrid; and sometimes assumes a yellowish, or greenish-yellow, puruloid appearance; the fever gradually subsides; and the recovery is usually complete in from five to seven days, unless the disease is kept up by improper management, or renewed by a repetition of the cause. In this case, it sometimes becomes chronic, and may then run on for weeks, months, or years. In a few instances, it retains a sort of acute character, with a thin acrid discharge, for a considerable time, probably in consequence of fresh attacks before the old have ceased. This watery secretion, so characteristic of the disease, and which has given it the name of coryza, is not invariably present; the inflammation being sometimes dry at the commencement, and remaining so until thick mucus, or muco-purulent secretion takes place.

Very frequently the inflammation travels downward into the bronchial tubes, constituting catarrh; but frequently also it does not extend beyond the nostrils, and immediately adjoining parts. Sometimes it affects one part only, being confined to one side of the nostrils, or to one of the sinuses. When it affects the frontal sinus, the symptoms are heaviness and pain in the middle of the forehead, extending frequently to the superciliary ridges and the eyes, with a disposition to more copious discharge from the nostrils when the patient rises, after having for some time maintained the horizontal posture. It is more especially to this condition of the complaint that the name of *gravedo* has been attached. In the maxillary sinus, the disease is usually indicated by pain and tenderness, with some swelling of the corresponding cheek, a similar condition of the gums on the affected side, and soreness of the teeth. A copious discharge from the nostrils when the patient turns upon his side is another characteristic symptom. Sometimes, however, the orifice into the nostrils is closed by inflammation, which, if not relieved, may end in abscess of the antrum, requiring the aid of the surgeon. Coryza is sometimes regularly intermittent. In new-born or very young infants, this disease is attended with some peculiar effects which require notice. In consequence of the stoppage of the nostrils, they have great difficulty in sucking, and may suffer from the want of nourishment. On attempting to take the breast, they sometimes become black in the face from suspended respiration, and are said occasionally to be thrown into convulsions by the same cause. In its severest forms, the complaint is asserted to have sometimes proved fatal. Another peculiarity in children is the tendency to exudation of coagulable lymph from the membrane, which forms solid layers upon the surface, as in diphtheritic inflammation of the fauces, which this affection sometimes accompanies. Such cases are always serious, and not unfrequently fatal, from the extension of the same kind of inflammation to the larynx or lungs. They may be known by the fetid odour of the discharge, the occasional ejection, in coughing or sneezing, of portions of the false membrane, and the appearance of the exudation either near the anterior nasal orifices, or in the fauces.

Causes.—The most frequent exciting cause of coryza, beyond all comparison, is the partial application of cold, as to the back of the head or neck, to the feet, &c.; and the effect is especially apt to be produced after perspiration from heat or exertion. Hence, the complaint is most common in winter. In some instances, it is probably induced by the breathing of a warm air after previous exposure to cold, in the same manner as chilblains. Some persons are much more liable to be affected in this way by cold than others. This greater susceptibility is frequently ascribable to a want of the habit of exposure; but it is often also constitutional, and inexplicable. Individuals are occasionally met with, who are liable to attacks of the complaint periodically, at a certain date, once a year, without reference to the state of the weather at the time. Others are attacked at the commencement of winter, and are scarcely entirely free from the complaint until warm weather returns. Coryza is also frequently epidemic, being a very general attendant upon the influenza. It is very common at the beginning of measles, and sometimes accompanies other exanthemata in their earlier stages, especially smallpox, and scarlet fever. Occasionally it is produced by the direct application of acrid vapours, or irritating powders, to the nostrils.

Treatment.—Most cases of this disease are so mild as not to require medical treatment, and scarcely to interrupt the avocations or pleasures of the patient. Even in those in which the physician is consulted, the gentlest measures only are in general required. When there is no fever, it is usually sufficient to direct a dose of sulphate of magnesia, abstinence from animal food, and the avoidance of exposure to cold or wet. Should the patient be under the necessity of leaving his house, he should clothe himself warmly, take care especially to keep his feet dry, and protect his nostrils by a handkerchief against the cold. Should the symptoms be more severe, and fever present, the treatment, in addition to the above measures, may consist of hot pediluvia made more stimulating by the addition of common salt or mustard, and the use of refrigerant diaphoretics, as citrate of potassa, acetate of ammonia, nitre, and tartar-emetic, variously combined to suit the circumstances of the case. The patient should be confined to bed, and should lie with his head raised by pillows. When there is much headache, with a full strong pulse, and the symptoms have not yielded to the above treatment, with additional purgation by one of the neutral salts, a little blood may be taken by the lancet from the arm, or, in case of inflammation of the frontal or maxillary sinuses, by leeches from the forehead or cheek, or from within the nostrils.

Various measures have been recommended to relieve the local symptoms, which are often very distressing. Dr. Physick was in the habit of advising the frequent inhalation, through the nostrils, of the vapour from a mixture of laudanum and Hoffmann's anodyne. Mr. Harrington, a dentist of Philadelphia, has found the affection, in several instances, to disappear at once and completely under the inhalation of chloroform. (*Med. Examiner*, N. S., iv. 295.) A lump of camphor held near the nostrils sometimes affords relief. I knew an individual who derived prompt relief from snuffing up powdered cloves. Powdered cubebs have been recommended in the same way. Steaming with the vapour of hot water, snuffing powdered gum arabic up the nose, the injection of oleaginous liquids with some narcotic ingredient, and the direct application of the vapour of acetic acid, are also among the measures occasionally resorted to. M. Deschamps has found a solution of extract of opium, made in the proportion of about a grain to a fluidounce of water, and drawn into the nostrils by inspiration, promptly effectual. One nostril is to be closed with the finger, and the liquid drawn in through the other, until felt to be about to enter the fauces, when it is to be allowed to flow out again. The application may be made every two hours if necessary; but seldom requires to be more than once repeated. (*Journ. de Pharm. et de Chim.*, xi. 370.) Dr. J. H. Douglas, of New Orleans, cures the severest coryzas by causing the patient to snuff a little laudanum up the nostrils, taking care that none is swallowed, and following this measure by a brisk cathartic. (*N. O. Med. and Surg. Journ.*, ix. 604.) Dr. John A. Lockwood has found the application of a solution of nitrate of silver, containing eight or ten grains in the fluidounce, applied by means of a camel's-hair pencil, to the mucous membrane of the nostrils, at the beginning of the attack, a sovereign remedy. (*Am. Journ. of Med. Sci.*, N. S., xviii. 21.) Injections of a solution of sulphate of zinc, of the strength of two or three grains to the fluidounce, have also been used. The patient will derive comfort from applying some stiff, mild, fatty matter, as suet or spermaceti cerate, to the upper lip and nasal orifices, in order to protect them against the irritating secretion. He should employ a soft linen handkerchief.

Dr. Williams strongly recommends an almost total abstinence from liquids, as an effectual cure for coryza. The secretion is arrested by the deficiency of the watery portion of the blood, and the inflammation speedily subsides, when no longer aggravated by the discharge. The coryza begins to disappear at the end of a day, and in the course of thirty-six or forty-eight hours the cure is generally completed, so that, after that time, the patient may resume the moderate use of drinks. After the commencement, and before the completion of the cure, a single copious draught may bring back all the symptoms. When there is fever, Dr. Williams precedes his dry plan by an aperient and an antimonial. If care be taken to keep the surface warm, exercise in the open air is rather beneficial than otherwise by promoting secretion from the skin; and any other *dry* method of favouring the healthy secretions contributes to the cure. The food should not be heating or saline so as to excite thirst, and the solid matters used may be moistened with liquids. Though "a total abstinence from liquids is most effectual, yet taking about a teaspoonful of tea or milk with breakfast and the evening meal, and a wineglassful of water on going to bed, does not prevent the success of the plan, whilst it diminishes its discomfort." As, according to Dr. Williams, the plan produces no injurious effects, the patient may well be allowed to choose between its discomfort, and that of the disease under ordinary treatment.

When, after the subsidence of the acute symptoms, the complaint continues obstinate, with a copious mucous or muco-purulent discharge, a speedy cure may sometimes be effected by a return to nourishing food, and free exercise in the open air. Sometimes violent exercise will of itself throw off an attack, in its earlier stages, by promoting perspiration.

If the complaint have the intermittent form, it may be readily cured by sulphate of quinia.

In infantile cases, it is necessary to feed the child by means of a spoon. Relief may sometimes be afforded by holding a sponge wet with warm water upon the nose. Dr. C. D. Meigs recommends strongly, as a very effectual remedy, to cover the head with a closely fitting flannel cap. (*Trans. of Col. of Phys. of Phil.*, iii. 63.) In severe cases, when the head is threatened, it will be proper to apply leeches, to administer a calomel purge, and to blister behind the ear, or at the back of the neck. In pseudo-membranous cases, it may become necessary to apply a solution of nitrate of silver by means of a camel's-hair pencil to the parts, or to blow powdered alum up the nostrils.

When an individual is subject to the complaint in its severer forms, and especially when previous experience suggests that it is likely to be the precursor of a protracted disease of the chest, it is important to be able to set the attack aside at its very commencement. This may often be done by a full dose of opium. More than thirty years ago, the author heard this plan suggested by the late Dr. Chapman, of the University of Pennsylvania, in his lectures, and he has had frequent opportunities of verifying the statements of Dr. Chapman as to its efficacy. From one to two grains of opium, or from ten to twenty grains of Dover's powder may be given at bedtime; and the

Causes.—In many instances, the chronic disease results from a continuation or frequent repetition of the acute. It is often also original. The cause is generally obscure. In some cases, it depends on foreign bodies in the nostrils, acting as nuclei for the deposition of solid matters from the secretion. In others, it appears to be associated with a scrofulous or gouty diathesis, with a tendency to scaly cutaneous eruptions, or with that disordered state of the digestive organs which so often gives obstinacy to chronic inflammation of the fauces. In the form of ozæna, when not ulcerous, it may depend upon some impediment to the free discharge of mucus from the nostrils or sinuses, which, consequently accumulating, becomes putrid and excites inflammation. In ordinary chronic inflammation, the accidental retention of the secretions may thus superadd the putrid character of ozæna. The offensiveness of the discharge, however, in some cases, cannot be traced to this cause, and is quite inexplicable, except upon the vague supposition of peculiar morbid constitutional tendencies. When associated with ulcers, it is most frequently dependent on a syphilitic, scrofulous, or scorbutic taint.

Treatment.—In simple chronic inflammation, cures may very often be effected by the injection into the nostrils of solutions of acetate of lead, sulphate of zinc, sulphate of copper, or nitrate of silver. I have usually preferred sulphate of zinc, beginning with two grains to the fluidounce of water, and rapidly increasing, as the nostrils are found to bear the impression, to ten, fifteen, or even twenty grains to the fluidounce. The injection should be repeated daily or twice a day, and continued perseveringly for months if necessary. It is important that, by a proper direction of the instrument, and position of the head, the fluid should be made to reach the seat of disease, whether this occupy the whole of the membrane, or, what is much more frequent, some comparatively small portion of it, in the nasal passages or the sinuses. Sometimes the part can be reached by a camel's-hair pencil, in which case, this is the best means of applying the solution, as the sound portions of the nostrils may thus be avoided, and a stronger solution may be employed. When the discharge is offensive, solutions of creasote, or of chloride of soda, potassa, or lime, will do much towards correcting the fetor, and may prove useful as alteratives to the mucous surface. Dr. Jackson, formerly of Northumberland, informed the author that, in a case of this complaint, he had found an injection of Fowler's solution, much diluted, completely to remove the fetor, and much to diminish the discharge. Caution, of course, is necessary not to allow the solution to be swallowed. Sometimes advantage will result from the mere washing out of the retained mucus, two or three times daily, by injections of warm water. When an ulcer exists, and is within reach, it may be treated by the direct application of solid nitrate of silver, or by a saturated solution applied by means of a camel's-hair pencil. Inhalations through the nostrils of diluted chlorine, and of the vapours of creasote, tar, and vinegar have been recommended. Blisters often repeated behind the ears, or at the nape of the neck, or on the arm, and issues or setons between the shoulders, may sometimes prove useful, especially in cases which may have followed the disappearance of a cutaneous eruption.

Remedies should also be addressed to the constitution. Their character must depend upon the peculiar diathesis, or general morbid condition which may exist. Syphilis, scrofula, and scurvy have their appropriate treatment, which should of course be applied when these constitutional affections exhibit themselves in this form. Even when the complaint can be traced to no particular morbid predisposition, still, good may occasionally be expected from alteratives, such as mercury, iodide of potassium, arsenic, and compound decoction or syrup of sarsaparilla. Tonics, and, in general, measures calculated to give vigour to the system, will be likely to prove useful. Among these may be mentioned a wholesome nutritious diet, exercise, fresh country air, sea-bathing, long journeys, and a sea-voyage.

Article II.

INFLAMMATION OF THE LARYNX, or LARYNGITIS.

The larynx, though most commonly involved in inflammation of other parts of the respiratory passages, is sometimes exclusively, and often chiefly affected. By some English writers laryngitis is considered as among the most dangerous, perhaps the most dangerous, of inflammatory diseases. But they restrict the term to a highly aggravated form of laryngeal inflammation, excluding altogether the milder forms of that affection. With as much propriety might we restrict the name of bronchitis or pneumonia to the very highest grades of these complaints, and then proclaim them as eminently dangerous. The truth is, that inflammation of the larynx is not uncommon, and is in general very manageable; though, in a few instances, when very intense, or attended with an unusual degree of serous effusion into the submucous tissue, it becomes very alarming and even fatal. Its great danger, under these circumstances, is owing to the narrowness of the passage through the chink of the glottis, which is closed by the swollen state of its walls, aided probably by spasm of the muscles, against the admission of air; so that the patient dies of true asphyxia. There is no other portion of the respiratory passages, in which an equal extent of inflammation is capable of producing the same fatal results. As in most other inflammations, the disease may be acute or chronic.

1. ACUTE LARYNGITIS.

Of the acute form, several modifications exist, according to the grade of action, the part attacked, or the character of the extravasated matter. Sometimes it is very superficial, affecting only the mucous tissue, and perhaps only the surface of the membrane. Sometimes it extends to the sub-mucous cellular tissue, involving that and the mucous membrane at the same time, thus greatly increasing the tumefaction, and consequently the danger. Again, the inflammation, which is usually attended with mucous secretion, occasionally gives rise to an exudation of coagulable lymph, which lines the larynx with false membrane. Finally, the sub-mucous tissue may be swollen simply as in ordinary acute inflammation, or may be distended with serum in a degree greatly disproportionate to the grade of inflammatory action, presenting indeed an edematous condition. These varieties may be conveniently considered under the three divisions of 1. *mucous laryngitis*, affecting the mucous membrane especially, and attended with mucous secretion; 2. *sub-mucous laryngitis*, in which the sub-mucous tissue is also involved, and sometimes chiefly so, as in the proper edematous variety; and, 3. *pseudo-membranous laryngitis*, which is characterized by the formation of false membrane. These are dangerous in the order in which they have been mentioned. But it must not be supposed that they are always distinct. On the contrary, they often run together, or differ only by almost insensible shades, so that they cannot be distinguished by the symptoms.

1. *Mucous Laryngitis.*—In its mildest form, this is marked by a slight hoarseness, without pain or difficulty of respiration, and often with little or no

cough, unless complicated with catarrh. It passes off in a few days, frequently without medical interference. When of a somewhat higher grade, in addition to the hoarseness, there is a feeling of soreness in some part of the larynx, together with tightness or stricture, a dry husky cough, and often a slight difficulty of inspiration. If the fauces are examined, they will frequently be found in a greater or less degree reddened. Under proper treatment, these symptoms speedily subside. Not unfrequently the inflammation descends into the bronchia, with relief of the laryngeal affection. But, if neglected, it may take on the character of a still higher grade of laryngitis. In this, the voice is from the beginning very hoarse or stridulous, and, in the progress of the disease, is almost or quite suppressed, so that the patient cannot speak above a whisper. There is almost always pain, sometimes severe, sometimes moderate, increased by speaking and coughing, and occasionally by external pressure. The patient often has the sensation as of a foreign body in the larynx. Inspiration is difficult, and often stridulous or tightly sounding, while the patient feels a distressing constriction of the throat, and exhibits some anxiety or apprehension about his ability to get breath. The cough is hoarse or muffled, and of a peculiar character, commencing as it were in the larynx, and obviously intended to remove some obstruction at that point. It is either dry, or attended with the discharge of a little tough mucus. In some instances, it comes on paroxysmally, and is almost convulsive. There is often some difficulty of swallowing, arising from coexisting inflammation of the fauces, from the pressure of the alimentary bolus upon the tender larynx, or simply from the motion of this structure in deglutition. Paroxysmal attacks of great oppression and dyspnœa are sometimes experienced, arising from spasm of the muscles of the glottis, such as occurs in croup. There is generally some degree of fever, which may have come on simultaneously with the local symptoms, or not until they had existed for some time. It cannot be doubted that there is in these cases considerable swelling of the mucous membrane; and it is not improbable that the sub-mucous tissue is often in some degree involved. Redness of the epiglottis may generally be seen by strongly depressing the base of the tongue, and inducing the patient to cough, or make the motion of swallowing. The attack gradually subsides under proper treatment, and goes off in from four to six days, sometimes by mere resolution, but more frequently with a secretion of mucus, which is at first transparent, but gradually becomes thick and opaque, if not purulent. Should the inflammation travel into the lungs, severe bronchitis is apt to ensue.

2. *Sub-mucous Laryngitis.—Œdematous Laryngitis.—Cynanche Laryngea.*—This differs from the preceding rather in degree than in character. It may be considered as the highest grade of acute laryngitis, extending to the subjacent areolar tissue. It is not many years since this was first noticed as a distinct disease. Washington is supposed to have died of it; and his case is said to have been the first recorded in detail. According to Cheyne, the disease was not generally understood until after the publication of a paper by Dr. Farre, in the third volume of the Medico-Chirurgical Transactions.

When originating in the larynx, and not the result of some direct violence, this form of laryngitis usually commences with a distinct chill, or with chilliness alternating with flashes of heat, which is followed by fever, with a full strong pulse, a hot skin, and flushed face. At the same time, some soreness of the throat is felt, the voice is hoarse, and a sense of tightness, stricture, or pressure is experienced, as if there were some mechanical impediment in the larynx. To remove this the patient coughs, but brings up nothing, or only a little clear viscid mucus. The cough is painful, and its sound is harsh and stridulous. Great difficulty of breathing soon comes on. The inspiration is prolonged, wheezing, whistling, or otherwise sonorous, and requires a considerable effort on the part of the patient. The expiration is performed more easily and silently; as the swollen membrane of the glottis acts like a closing valve against the entrance of the air, but opens readily for its exit. Upon examining the fauces in the manner described above, the epiglottis may sometimes be seen of a bright or deep-red colour, erect, and much swollen, so as to be unable to descend and close the glottis during deglutition. The external parts about the larynx are also often much swollen, though not invariably so. Deglutition is difficult, partly from inflammation of the fauces, but chiefly in consequence of the swollen state of the epiglottis, which prevents it from closing accurately over the orifice of the windpipe, and thus allows the substances swallowed to enter the larynx, where they excite intense irritation, and give rise to vehement paroxysms of coughing, with the most distressing dyspnœa. Dr. Watson relates a case in which, after laryngotomy, a portion of anything swallowed appeared immediately at the wound. (*Lect. on Princip. and Pract. of Med.*)

Should the case continue to advance, all the symptoms are aggravated. The voice becomes wheezing or whispering, or is quite extinguished; the cough of which the sound is scarcely above the breath, is agitating, often convulsive, and very painful; inspiration is exceedingly difficult, and is accomplished only after violent efforts, with great distress and anxiety, and a feeling as of impending suffocation. The patient is in general extremely restless, sometimes starting up suddenly in bed, walking about the chamber, putting his hands to his throat, showing the greatest eagerness for fresh air, and expressing in his countenance an almost fearful anxiety, apprehension, and distress. He is unable to sleep longer than a few minutes at a time, being roused by the necessity for voluntary effort to get breath. The blood now begins to exhibit signs of deficient aëration, which rapidly increase in intensity. The lips have a bluish or purplish colour; the face becomes of a livid paleness; and a dark circle forms about the eyes, which are sometimes protruded and watery. The surface is cool, and the pulse frequent, irregular, threadlike, and very feeble. In the midst, however, of this exhaustion, the patient makes the most violent efforts; his shoulders rise; his whole chest heaves; his countenance assumes a staring and ghastly expression; his skin is bathed in a cold sweat; and he sinks at last into a drowsy or comatose state, often preceded by delirium, and quickly followed by death.

The fatal effects depend upon the want of air to support respiration, and the consequently carbonated and poisonous state of the blood, which no longer affords the due stimulus to the vital functions. Sometimes this condition of the blood is sufficient to cause death, even though respiration should be restored. Thus, patients not unfrequently die in the intervals of violent dyspnœa, when air is no longer excluded from the lungs, and sometimes even after the operation of tracheotomy, though the lungs themselves are not embarrassed. The nervous system is unable to recover from the depressing influence of the black blood. Death may, therefore, occur either suddenly, from complete closure of the passage; or gradually from a partial and insufficient supply of air, causing a change of blood, the effects of which a subsequent return of respiration cannot always obviate.

The disease is very rapid; generally, when fatal, ending in from three to five days, and sometimes much sooner. Death has been known to occur in seven hours. Sometimes, however, the complaint is protracted for several weeks. Its duration depends in general upon the degree of internal tumefaction in the larynx, though it is probable that life is sometimes suddenly terminated by the supervention of spasm of the glottis. I have seen a case, in which spasm of this kind recurred frequently at short intervals, each time attended with complete suspension of respiration, and partial insensibility from asphyxia, during the relaxation of which, air again entered the chest, and thus prevented immediate death. This case ultimately recovered under copious depletion, and tobacco cataplasms.

Occasionally the attack is very sudden; the dyspnœa and all the other bad symptoms occurring in the course of a few hours. In other cases, it is gradual. The disease varies also much in the grade of inflammation. Sometimes this is very violent; sometimes it is comparatively moderate, and the danger depends rather upon a copious serous effusion into the submucous tissue than ordinary inflammatory tumefaction. Cases of the latter kind are distinguished by the name of *edematous laryngitis*. In these, there is little pain in the throat, or tenderness upon pressure, and little or no febrile disturbance. If the epiglottis can be seen, it is observed to be much swollen, but rather pale or livid than of a bright-red colour. The symptoms, however, arising from closure of the rima glottidis, are not less urgent, and the disease is perhaps even more fatal, because it does not so well tolerate antiphlogistic treatment. Cases are said to have occurred, in which this œdema of the larynx was strictly dropsical; but such cases are, to say the least, exceedingly rare. In most instances, the effusion undoubtedly depends upon a low grade of inflammation; and the peculiar result is probably owing in general to peculiarity of the constitution or of the blood, predisposing to serous effusion under inflammatory action. Dr. Stokes says that this variety of laryngitis is sometimes consequent upon the inflammatory swelling in the vicinity of the parotid, which occasionally follows continued fever.

In all its varieties, the disease may exist either alone, or in connexion with inflammation of the fauces and tonsils, of the trachea, or of the bronchial tubes.

The *diagnosis* is sometimes a point of much importance. It is very necessary that the complaint should not be confounded with diseases of the chest, which are sometimes attended with severe dyspnœa, and similar constitutional symptoms. But, in the latter, either the disease is chronic, or is accompanied with such obvious symptoms of pectoral disorder that there can scarcely be room for mistake, if due examination be made. Besides, in affections of the larynx, the change of the voice, the feeling as of a foreign body in the throat, the laryngeal cough, the seat of pain, tenderness, and constriction, the great difference between the facility of inspiration and expiration, and the results of local inspection, point beyond all doubt to the true seat of disease. Some of the French practical writers speak of the introduction of the finger into the posterior fauces, and the perception of a cushion formed by the tumefaction of the border of the glottis (Valleix, *Guide Méd. Prat.*, 2e ed., i. 240); but this mode of examination must be difficult, and might possibly aggravate the inflammation. Aneurism of the aorta, by pressing on the windpipe, has given rise to symptoms which have been taken for those of laryngitis; but auscultation would render such a mistake impossible. Abscesses near the larynx may sometimes simulate laryngitis so far as to lead, upon superficial examination, to an erroneous diagnosis; but a close inspection of the parts would correct the error, and it is only necessary that the attention of the practitioner should be awake to its possible occurrence. To one of the forms of croup, laryngitis bears a close analogy; but, in the former, spasmodic contraction of the muscles of the glottis, in the latter, swelling of the lining membrane or the parts beneath it, is the prominent and characteristic phenomenon. More will be said upon this subject under croup. With mere spasm of the rima glottidis, unconnected with inflammation, it is scarcely possible to confound it, even leaving out of consideration the fact, that this affection is rare in adults, and confined chiefly to hysterical women.

This form of laryngitis is considered by many writers as exceedingly fatal. By far the larger proportion of persons attacked with it are thought to perish. But it is very certain that individuals, attacked with symptoms in all appearance identical with those of sub-mucous laryngitis, often recover. It is true that they cannot be positively proved to have had effusion in the sub-mucous tissue, as the evidence of dissection is wanting. Judging from my own observation, I should say that, when the disease makes its attack in the form of open and decided inflammation, in a person of tolerably vigorous constitution, and not previously labouring under chronic disease of the larynx, it may generally be cured, if attacked in its early stages, before the powers of the system have begun to give way under the depressing influence of the black blood. After this deterioration has commenced, the chances of saving the patient are very much diminished. Of the cases published a large proportion have proved fatal; because, in consequence of the difficulty of adducing positive proof of the character of the affection from the symptoms alone, it is chiefly the fatal cases that have been brought before the public. When the disease supervenes upon chronic laryngitis, as not unfrequently happens, it may be considered as almost incurable; as too little vigour of system remains to support the requisite measures. For the same reason, it is more than ordinarily dangerous in its edematous variety, which is most likely to occur in persons of feeble health.

3. *Pseudo-membranous Laryngitis.*—This is exceedingly rare in adults. In severe cases of inflammation of the larynx, patches of coagulable lymph may sometimes be found upon the surface of the mucous membrane after death; but these are not sufficiently extensive to be of themselves a serious source of danger. Sometimes an extension to the larynx of a pseudo-membranous condition of the fauces has taken place in adults, with fatal results; but even such cases very seldom occur, so that many practitioners in extensive business have probably never seen an instance. In children the disease is not uncommon, and in them it constitutes a variety of croup. To the article upon that disease the reader is referred for all that is deemed requisite to be said upon this form of laryngitis. (See *Croup.*)

Besides the forms of acute laryngitis above described, another has been noticed in which the perichondrium appears to be the seat of the inflammation. It is very rare, but has been known occasionally to attend or follow smallpox and typhoid fever; and to occur originally from direct injury, and exposure to cold. I know of no symptoms by which it could be certainly distinguished during life. After death, pus has been found bathing the cartilaginous surfaces.

Appearances after Death.—The mucous membrane lining the larynx is gorged with blood, softened, and thickened, while the subjacent cellular tissue is distended with bloody serum or a sero-purulent fluid. This tumefaction affects especially the epiglottis, and the upper part of the larynx, extending often no further than the ventricles. It seldom reaches the trachea, of which, however, the lining membrane often shows an increased vascularity. The thickening is so great about the glottis, that the chink is almost closed, so that when held up to the light only a few rays can penetrate through it. The surface of the membrane is usually covered with mucus, and sometimes exhibits patches of coagulable lymph, which is also occasionally found effused in the sub-mucous tissue. In the edematous variety, there is little injection of the mucous membrane, but great swelling, in consequence of the effusion of serum beneath it.

Causes.—The most frequent cause of laryngitis, in all its forms, is probably partial exposure to cold, or to cold and wet, especially when in a state of perspiration from heat or exercise. There is in some individuals a peculiar predisposition to be affected by this disease; so that when any general cause of inflammation acts, it is almost certain to affect the larynx. Persons similarly predisposed to tonsillitis, are said to be also peculiarly susceptible to laryngitis; the force of the morbid influence falling sometimes on one part, and sometimes on the other. A continued, frequent, and powerful exertion of the voice sometimes produces the complaint, and often predisposes to it. Other causes are such as produce direct injury to the larynx. Among these are scalding water or corrosive liquids, which an individual may accidentally attempt to swallow; flame or hot air inhaled during exposure to fires; corrosive irritating gases, vapours, or powders taken in with the inspired air, and arrested in some measure at the glottis; the unskilful insertion of instruments; and external violence. The author has witnessed a very severe case resulting in a child from smelling at a bottle of chlorine. Another source of the disease is the propagation of inflammation from neighbouring parts. Inflammation of the fauces is very apt to extend to the larynx, and to retain in the latter the character which it had in its original seat. Thus, if confined to the mucous membrane in the fauces, it is apt to be similarly limited in the larynx; if pseudo-membranous in the former, it is also pseudo-membranous in the latter; if sub-mucous in the one, it retains the same relative position in the other. Hence, when tonsillitis is propagated to the larynx, the disease sometimes assumes the worst forms of sub-mucous laryngitis. Mercurial stomatitis, according to Cheyne, sometimes extends into the larynx. Erysipelas, and the sore-throat of scarlet-fever, sometimes prove fatal by reaching that structure, and giving rise to sub-mucous or pseudo-membranous inflammation. Measles, catarrh, and smallpox also occasionally give rise to some form of laryngitis. The affection occurs as an accompaniment or consequence of typhoid fever. Aneurism of the aorta may produce it, by the propagation upward of the bronchial inflammation which it causes. Cheyne considers intemperance as a predisposing cause of the complaint. It is said that the disease is most common in middle and advanced life, and very rare in infancy. This is true of the sub-mucous variety. The other forms of laryngitis are not uncommon in the young; but in these they are apt to assume the form of croup.

Treatment.—In slight cases, a dose of sulphate of magnesia, a vegetable diet, and, if the weather be cold or damp, confinement to the house for one, two, or three days, are the only remedies required. Should the fauces, upon examination, be found reddened, a solution of alum may be employed twice a day as a gargle. These simple measures will often avert a serious increase of the inflammation, or its propagation to the bronchia.

When the disease is more severe, with febrile action and a strong pulse, blood should be taken from the arm once or oftener, in quantities proportionate to the violence of the symptoms, and the apparent vigour of the patient. After the first bleeding, from five to fifteen grains of calomel should be administered, either in connexion with or followed by another cathartic, to insure its action on the bowels. These should afterwards be kept freely open, throughout the complaint, by saline aperients if required. If the disease do not yield, the purgative should be followed by tartar emetic or ipecacuanha, in diaphoretic or nauseating doses, given at short intervals, together with the neutral mixture or effervescing draught, if the skin be hot and dry. With these measures may also be combined hot and stimulating pediluvia. From the beginning, the throat may be enveloped in an emollient poultice, containing a very small proportion of mustard, sufficient merely to produce a feeling of warmth upon the skin. When bleeding from the arm seems to be no longer called for, leeches may be applied freely over the larynx, and will often be found at once to cut short the disease. Should spasm of the glottis accompany the inflammation, the antimonial may be given in an emetic dose, and the system afterwards be kept moderately under its influence, in conjunction with tincture of lobelia, which exercises a powerful influence over this affection. In case of failure by these means, a cataplasm of tobacco should be applied to the throat, due caution being exercised to prevent a too prostrating influence from this powerful sedative. I have witnessed the happiest effects from this remedy in very alarming cases. Should the skin be denuded, from any cause, in front of the neck, the cataplasm may be applied to the back of the neck or between the shoulders. In the more advanced stages, syrup of seneka and syrup of squill, or the same medicines in other forms, are often of advantage in conjunction with antimonial or ipecacuanha wine; and at this period, small doses of opium or hyoscyamus will often be found useful by allaying cough, without the objection to which the former remedy especially is liable in the early stage, in consequence of checking secretion. A blister to the neck will also chime in happily with these remedies. If the disease still remain unsubdued, recourse should be had to the mercurial influence, which will seldom fail, in cases of ordinary inflammation, at this stage. During the whole treatment, the patient should avoid using his voice altogether, or speak only in a whisper, and should suppress the cough as much as possible. Rest and low diet are also requisite.

In the violent cases described under the title of *sub-mucous laryngitis*, it is of the utmost importance to employ active remedies promptly. If postponed until the purple lips and livid paleness of the face indicate an insufficiently aërated blood, they will be of little avail. In the early stage, if not forbidden by the debility of the patient, blood should be taken very freely. In a robust adult, from twenty to thirty ounces may be drawn at the first bleeding, and the operation repeated once or oftener if necessary. The loss of blood should stop short of syncope. The obstruction to the respiration consists in an internal tumefaction of the larynx, which is not at once removed by the bleeding. A certain amount of muscular force is necessary to overcome the resistance in the glottis; and, if the patient be bled to fainting, there might be some reason to fear that his returning powers would be insufficient for that purpose, and consequently that the syncope might be fatally prolonged. Nor is this copious bleeding applicable to the edematous cases, attended with but a moderate degree of inflammation, and little or no fever. It might prostrate the patient below the point of reaction. Moderate venesection, however, is both tolerated and required. In the highly inflammatory cases, the lancet should be aided by the very free use of leeches to the throat. From fifty to one hundred American leeches may be applied in robust cases. Apprehension has been expressed lest they might increase the difficulty, in consequence of the superficial inflammation they excite producing subcutaneous extravasation. But the danger is from effusion within and not without the larynx, and if the latter should result from the leeches, it might act usefully by revulsion. It could scarcely be injurious. Nor should the leeches be delayed in these cases. Take blood once from the arm, and as soon afterwards as the patient's strength will permit, apply them. Should they not be attainable, cups may be substituted, to the side or back of the neck or between the shoulders.

Next to the loss of blood, calomel is the most important remedy. It should be given in the full dose at once, and afterwards in smaller doses, at stated intervals, until the system is brought under its influence. For this purpose, two grains may be given every two or three hours, either alone, or combined with opium and ipecacuanha, should these not be contraindicated. Mercurial frictions to the inside of the extremities may also be employed to hasten the effect on the system. As soon as any soreness of the gums is perceived, the mercurial should be moderated or suspended; as there might be some danger from its excessive action. Small doses of Dover's powder are a useful addition to the calomel, when given with a view to its general effects, by preventing it from running off by the bowels. They are also useful in moderating the cough, which is itself a source of mischief by still further irritating the inflamed parts. The opiate, however, should not be carried to the stupefying point; and, if the disease should be complicated with bronchitis, ought not to be used in the early stage.

Some practitioners place great reliance upon the antimonials in this affection. Dr. Stokes considers them even more important than calomel. They may be used as auxiliaries, but care should be taken to avoid vomiting; as the matter discharged would be very apt to enter the glottis, and provoke the most vehement and distressing paroxysms of cough and dyspnœa.

The measures recommended for the milder forms of laryngitis may also be employed, as occasion may seem to call for them; but the chief dependence must be placed upon the heroic remedies above mentioned. Should a blister be employed, it should be placed upon the sides or back of the neck rather than in the front, where it would be in the way of laryngotomy. The strong solution of ammonia would, in some cases, be preferable to cantharides, in consequence of the rapidity of its action.

In the asthenic cases, which will not bear bleeding, reliance must be placed upon leeching, blistering, and the prompt and efficient use of mercury. The only circumstance, under which the last-mentioned remedy is contraindicated, is the complication of the disease with chronic tuberculous or scrofulous laryngitis.

When bleeding and mercury fail, the only remedy upon which much reliance can be placed is the opening of the larynx or trachea. As soon as the system begins to exhibit a depravation of the blood, and a disposition to sink, this remedy should be at once resorted to. It may even be employed in the earlier stages when the danger of suffocation is imminent. The only condition which positively forbids it is the existence of extensive pulmonary disease, which would render death certain at all events. It is highly important that it be not postponed too long; for, in the advanced stages, death sometimes takes place in consequence of the state of the blood, even though air be freely admitted into the lungs. Nevertheless, the remedy should not be omitted. Recoveries have sometimes taken place, through its instrumentality, under apparently desperate circumstances. Well authenticated cases are on record, in which patients have been restored after respiration had ceased, and the pulse could no longer be felt at the wrist. In such instances, it might be proper to resort to artificial respiration, after the opening has been made. The effect of the operation is to admit air into the lungs, and it is surprising how speedy and complete is the relief sometimes afforded. The patient, exhausted by wakefulness, suffering, and the labour of respiration, sinks into a calm slumber almost immediately after the opening has been effected. Respiration is afterwards maintained for some time through the artificial passage. The laryngeal inflammation may now be cured at leisure by proper remedies. It will indeed generally subside of itself, with a secretion, more or less copious, of muco-purulent matter. The performance of the operation belongs to surgery. Laryngotomy is generally recommended; and the opening should be made between the cricoid and thyroid cartilages. Some advise the upper part of the trachea as the seat of the operation. If not liable to surgical objections, the latter position would appear to be preferable, on account of the danger of augmenting the laryngeal inflammation, by the introduction of the tube necessary to keep the opening pervious. The inner extremity of the tube should be prevented from projecting into the cavity, beyond the level of the mucous surface. Sir Charles Bell sometimes keeps the wound open by blunt-hooks, inserted in each side, and fastened behind the neck. Some attention to the opening is necessary after the operation. As much mucus is often discharged, it is advisable that the patient should facilitate the coughing necessary for its expulsion by placing his finger, after inspiration, on the orifice of the tube, and retaining it there until the effort of expiration has acquired force enough to drive the air vigorously through the opening. Care, too, should be taken that the patient be properly watched during sleep, and the mucus which accumulates, and might possibly suffocate him, be removed. After the subsidence of the inflammation, the glottis again opens; and, the patient being now able to breathe by the natural passage, the tube should be removed, and the opening allowed to close. The voice, which is lost for a time after the operation, returns with a restoration of the larynx to its healthy state.*

Dr. Gordon Buck, of New York, found decided benefit from incisions in the edges of the glottis, and in the epiglottis, by means of a guarded bistoury, in a case of œdema of the glottis. (*Annalist*, July 15, 1837.) Dr. T. R. Varick, of New York, applied a solution of nitrate of silver, of the strength of two scruples to the fluidounce, by means of a sponge affixed to a curved bougie, to the inner surface of the larynx, in an apparently almost desperate case of acute laryngitis, from which the patient afterwards recovered; and, though other active treatment was employed, the cure was ascribed chiefly to this measure. (*N. Y. Journ. of Med.*, x. 72.) This remedy is especially indicated in the pseudo-membranous variety.

2. CHRONIC LARYNGITIS.

Syn.—Laryngeal Phthisis.

Like the acute inflammation of the larynx, this differs much in degree and in danger, being in its mildest and simplest form nothing more than a chronic hoarseness, which is scarcely inconvenient and not at all dangerous; while, in its higher grades and with certain complications, it is one of the most serious diseases to which the human frame is liable. In the earlier stages, however, it is often impossible to discriminate between cases of the most opposite tendencies; as the most fatal frequently commence with the same symptoms as the most trivial; so that the affection, even in its mildest form, always merits attention. So long as the mucous membrane, though inflamed, maintains its integrity, there is comparatively little inconvenience. It is only when ulceration takes place, that the case begins to present a very alarming aspect. Now, in ordinary inflammation, without any peculiar morbid constitutional tendency, neither the mucous membrane nor any other constituent of the larynx has a disposition to ulcerate; and the disease, after a longer or shorter duration, almost always gets well under appropriate treatment. Upon the occurrence of ulceration, there is generally reason to suppose that some morbid complication exists, calculated to render the disease in the highest degree obstinate and dangerous. This complication is almost always either a tuberculous tendency of the system, or syphilis. In some very rare instances, it may be cancer, or other malignant local disorder. In by far the greater number of cases, it is the first-mentioned cause that renders chronic laryngitis dangerous. In fact, this complaint, in its severer forms, is very generally associated with tubercles of the lungs. It is a very common incident in the course of phthisis, and, when it occurs originally, is generally attended with the formation of pulmonary tubercles, and complicated, before its close, with the symptoms arising from their ordinary progress. There appear, however, to be cases in which the mucous follicles become the seat of ordinary inflammation, and in which ulceration may take place, without complication either with the scrofulous diathesis or syphilitic disorder.

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* For various information and views on the subject of "bronchotomy in edematous laryngitis," see a paper by Dr. Felix Sestier, in the *Archives Générales*, 4e sér., xxiii. 385, and xxiv. 35, 297, and 441.

The disease, when not consequent upon an acute attack, generally begins with hoarseness, a little uneasiness in the throat, and a slight laryngeal cough, which is often rather a clearing up of the throat or hawking than a proper cough, such as occurs in pulmonary affections. In this condition, with occasional aggravations and remissions, it may continue for months, and ultimately disappear, especially upon the occurrence of warm weather. Frequently, however, the symptoms are less mild. Various morbid sensations are felt in the larynx, such as heat, dryness, constriction, itching or tickling sensations which provoke cough, and sometimes dull, smarting, or even acute pain, increased by coughing or any strong exertion of the voice, and occasionally by pressure. But, in a large portion of cases, even those of a fatal kind, there is little or no pain through the whole course of the complaint. The voice is always in some degree altered, being generally hoarse or husky, sometimes stridulous or squeaking, and sometimes whispering. The change of voice is more perceptible when the patient attempts to speak loudly or to sing. The cough is at first usually short and dry, but becomes loose as the complaint advances, and is attended with a mucous or muco-purulent discharge. It is apt to be excited by speaking loud, or by the inhalation of cold air or irritating substances. If the fauces be examined, they will sometimes be found to exhibit the appearances of chronic inflammation, and among others, enlargement of the mucous follicles, as described under *Pharyngitis*.

All the symptoms above enumerated may occur without ulceration, though not inconsistent with it; for ulcers do not always give evidence of their existence, and not unfrequently occur before they are even suspected. But, generally speaking, the ulcerative stage is marked by some of the following phenomena. In cases attended with follicular inflammation of the fauces, the follicles within view exhibit signs of ulceration. There is often a pricking sensation in the larynx, as if from a sharp or pointed body, especially when the patient speaks. Deglutition is not unfrequently painful, and sometimes, in consequence of ulceration of the epiglottis, occasions violent paroxysms of coughing, with sensations as of suffocation, and a return by the nostrils of what the patient attempts to swallow. In some instances, however, there is no difficulty of swallowing from the beginning to the end of the case. The voice is still more altered than in the earlier stage, and is very variously affected, being hoarse, or whistling, or hollow, or quite lost, in the last case indicating ulceration of the rima glottidis, and partial destruction of the vocal ligaments. The cough undergoes analogous changes, being hoarse, croupy, stridulous, or altogether without sound above the breath. Sometimes, in the last stage, it has a peculiar loose continuous character, ascribed by M. Trousseau to inability to close the glottis. The discharge is now purulent, and occasionally bloody and fetid. Sometimes patches of coagulable lymph are detached from the membrane and thrown up, with at least temporary relief to the symptoms. Instances too are mentioned, in which portions of the cartilages, sometimes ossified, and calcareous concretions, are found among the matter discharged. The respiration is often difficult, though occasionally somewhat relieved after free suppuration, in consequence probably of the removal by ulceration of tumefactions, which may have narrowed the passage. It may be wheezing, hissing, or otherwise noisy, and is sometimes merely tight, as if the air were drawn through a narrowed passage. The difficulty is sometimes continuous, but is more frequently in some measure paroxysmal, being brought on by attempts to swallow, by bodily exertion, or by irritations of any kind provoking spasm of the glottis. Sometimes the patient dies in one of these paroxysms. In other cases, he is carried off by the supervention of sub-mucous effusion as in acute laryngitis. Still more frequently the general health gives way. Debility, emaciation, night sweats, frequency of pulse, œdema of the extremities, loss of appetite, occasional nausea and vomiting, and obstinate diarrhœa, mark the approaching close; and the patient dies in a state of hectic exhaustion.

It is not always easy to distinguish the different varieties of chronic laryngitis. If the symptoms indicating the existence of ulcers are wanting, if the chest is perfectly sound, and the general health of the patient unimpaired, there is reason to suppose that the inflammation may be of the ordinary kind, and to hope that it may yield to treatment. But if the disease has continued long and gradually increased, if a pricking pain is felt in the larynx, if the matter discharged is purulent, bloody, sanious, or fetid, if deglutition provokes paroxysms of cough and dyspnœa, if the voice has become broken or extinct, and the cough nearly aphonic, if the larynx crepitates under pressure, and the epiglottis can be seen ulcerated or deformed, if these or some of these symptoms are present, and at the same time the general health appears impaired, the probabilities are that the laryngeal disease is of a scrofulous or syphilitic character. Should evidence of tubercles in the lungs be afforded, or the patient in other respects show any signs of a scrofulous or tuberculous habit of body, the complaint may be considered as of the former kind. The pre-existence of syphilis in other forms, and the absence of the ordinary local signs of phthisis, would determine in favour of the latter. It is said that laryngeal phthisis has sometimes occurred, and proved fatal, without tubercles in the lungs or elsewhere, and without the suspicion of syphilis. This may possibly be the case; but the instances are very rare. In such cases, we may ascribe the obstinacy of the local disease, at our pleasure, to the peculiar circumstances of the structure in which it is situated, or to a scrofulous or other concealed vice of constitution. We have no means of deciding the question.

In relation to the prognosis in these several cases of ulcerative laryngitis, it may be stated that, when the disease is connected with pulmonary consumption, the two together are almost necessarily fatal; that the syphilitic variety may generally be cured in its earlier stages, and is seldom quite desperate; and that, when neither of these complications exist, and no other serious depravation of the general health can be discovered, we may entertain a reasonable hope of making a favourable impression on the complaint.

Appearances after Death.—If the patient happens to be carried off in the earlier stage, the mucous membrane is found red, thickened, softened or indurated, and often rough from the enlarged follicles. At a more advanced period, ulcers are found in various situations, most frequently between the vocal ligaments and epiglottis, sometimes superficial, sometimes deep, penetrating through the mucous membrane to the cartilages, and occasionally even through these. Dissecting abscesses meander among the different structures, and sometimes result in external fistulous openings. The cartilages themselves are changed, being sometimes ossified or encased in bony matter, and sometimes partially in a state of caries, or of necrosis, with the dead portions surrounded by ulceration, and bathed in a fetid pus. The epiglottis is sometimes irregularly contracted, ulcerated, and partially or wholly destroyed; as are also the vocal ligaments. The sub-mucous tissue is infiltrated with serum or pus, or thickened and indurated; and the ventricles are sometimes obliterated from this cause. The muscles of the larynx are wasted, hardened, or otherwise degenerate, and the ligaments contracted and distorted. Excrescences of various kinds appear on the surface of the mucous membrane, especially in syphilitic cases. It is stated that, in syphilis, ulcers are apt to form on the anterior surface of the epiglottis, while in scrofulous cases they occupy the posterior surface. [illegible] states that he has not found tuberculous granulations upon the surface, or in the substance, of the epiglottis or larynx.

Causes.—The ordinary causes of acute laryngitis may produce also the chronic form, when operating with less force, or upon less susceptible subjects. Among these the most common are cold, an excessive use of the voice in speaking or singing, irritating substances inhaled, propagation of inflammation from the fauces above and the bronchia below, foreign bodies in the larynx, mechanical violence, the retrocession of cutaneous eruptions, and sometimes probably gout and rheumatism. The disease appears to be occasionally connected sympathetically with chronic gastritis. It is often the result of inflammation propagated from the fauces to the larynx. The abuse of sensual pleasures is thought to predispose to the complaint, which is said to be very common among drunkards and prostitutes. The scrofulous diathesis constitutes a predisposition to it. Polypous excrescences, warts, and other tumours in the larynx or its vicinity, may also be counted among the causes. The chronic disease occasionally succeeds the acute. It is said to be rare in infancy and old age, and most common between the thirtieth and fortieth year. Men are more frequently affected than women.

Treatment.—In the early stages, moderate depletion, rest as complete as possible to the organ, and revulsion by means of a steadily sustained external irritation, are the chief remedies. It may sometimes be proper, during an access of excitement, to take a little blood from the arm; but this is seldom required. Leeching is safer and more effectual. Cups may also be applied to the side or back of the neck. In order to rest the larynx, the patient should abstain from speaking aloud, and from singing; and cough should be allayed by opium, hyoscyamus, lactucarium, extract of hemp, or some other narcotic. It has been recommended to rub unctuous preparations of hyoscyamus, belladonna, &c., over the larynx; and plasters of opium and of belladonna have been used with the same view. For revulsion, a perpetual blister, pustulation by croton oil or tartar emetic long sustained, or a seton to the back of the neck, may be employed. The patient, if exposed to the inhalation of irritating substances, should be protected against them, by means of a fine gauze veil, or respirator. The diet should be nutritious but not stimulating, and should consist chiefly of vegetables, farinaceous preparations, and milk, with little or no meat. In the somewhat advanced stages, sencka may sometimes be found useful; but the most effectual remedy, when other means fail, is mercury pushed to a very moderate ptyalism. This will often cure chronic inflammation, of the ordinary, or the syphilitic character. It is not adapted to scrofulous cases. In these, more reliance should be placed on the preparations of iodine, especially the iodide of potassium; and iodine ointment may be rubbed upon the throat. Means should also be employed to support the general health, such as wild-cherry bark, and the chalybeates; and, in these cases, the diet may contain a larger proportion of animal food, especially when the disease is far advanced into ulceration and suppuration. Cod-liver oil is a most valuable remedy in this form of the disease.

Local applications to the diseased surface are very important. The smoking of stramonium leaves, belladonna, hyoscyamus, and tobacco, has been recommended; as have also inhalations of the vapour of heated water impregnated with chlorine, iodine, camphor, turpentine, tar, creasote, or ether with extract the rima glottidis into the cavity of the larynx. He recommends that the patient, upon opening his mouth, "should take a full inspiration, and then breathe gently out, at the moment in which the sponge is introduced." This is carried over the top of the epiglottis, along the posterior surface of this cartilage, and then suddenly pressed downward and forward through the aperture. A momentary spasm of the glottis takes place, by which the sponge is compressed, and the fluid forced out of it. The application should generally be made every other day for the first two weeks, after which it may be repeated two or three times a week, until a cure is effected. (*Treatise on Dis. of the Air Passages*, &c., N. Y., p. 199, &c.)

Dr. Cotton, of London, employs a pair of curved forceps, with flattened blades, to the end of one of which a small piece of sponge is firmly attached. This being saturated with the solution, the instrument is introduced into the fauces, and the blades are closed, so as to compress the sponge, and cause the liquid to fall directly into the larynx. (*Lond. Med. Times and Gaz.*, June, 1852, p. 579.)

In the closing period of the disease, it sometimes becomes necessary, in consequence of the difficulty and danger of swallowing, to support the patient by the introduction of food through a stomach tube; and occasionally it may be necessary to perform the operation of tracheotomy, in order to avert immediate death.

Article III.

INFLAMMATION OF THE BRONCHIA, or BRONCHITIS.

In a pathological account of the several portions of the air-passages, it might be thought that the trachea should receive a separate consideration; but it is very seldom exclusively affected, offers no symptoms when inflamed which are not observed in other localities, and requires absolutely nothing peculiar in the treatment. The nomenclature which gives the title of *tracheitis* to croup, is founded on a false assumption in relation to the especial seat of that complaint. It is true that the trachea is generally affected in croup; but it is almost never exclusively affected; nor are the peculiar features of the disease essentially connected with that part of the respiratory passages. (See *Croup.*) The symptoms and treatment of tracheitis are almost always merged in those of laryngitis and bronchitis.

The term *bronchitis* is applicable to any case of inflammation of the bronchial tubes, whatever may be its grade, character, or precise locality. It will be here considered under the two heads of acute and chronic bronchitis.

1. ACUTE BRONCHITIS.

This designation has been restricted by some writers, without any very obvious propriety, to the higher grades of inflammation of the bronchia. The author considers it applicable to every case of short duration. In this sense of the term, acute bronchitis is one of the most common diseases to which man is liable. It varies very greatly in degree, and somewhat in character. The inflammation begins very frequently in the nostrils, fauces, or larynx, and thence descends into the bronchia; and is very apt to retain in the last mentioned position, unless modified by treatment, the grade of severity which characterized it at the outset.

of hemlock. Liquids and powders have also been applied to the larynx, and sometimes with great asserted advantage. For this purpose, solutions of corrosive sublimate, nitrate of mercury, sulphate of copper, and nitrate of silver, and powders of subnitrate of bismuth, red oxide of mercury, calomel, sulphate of zinc, sulphate of copper, alum, acetate of lead, and nitrate of silver, all variously diluted with sugar, have been employed by M. Trousseau.* Of these substances, nitrate of silver is upon the whole the most manageable and efficacious. It was commonly employed by M. Trousseau dissolved in distilled water, in the proportion of one part of the nitrate to two or four parts of the menstruum, forming a strong caustic solution. Others have used a much weaker solution, containing only fifteen or twenty grains in the fluidounce.

Nitrate of silver has the great advantage of combining superficially with the tissues, and thus affecting only the surface, so that little danger need be apprehended of extensive mischief, if the application be properly made. Various plans have been proposed by M. Trousseau and others. One of the simplest is to introduce a drop of the solution into the glottis, by means of a slender roll of stiff paper, bent downward at the extremity; the base of the tongue being strongly depressed and somewhat drawn forward, and the patient directed to make the motion of swallowing, so as to raise the larynx. Another mode is to apply quickly to the same part, similarly brought within reach, a small piece of sponge, firmly secured to the end of a piece of bent whalebone, and saturated with the solution. A third method of Trousseau's was to inject into the glottis the solution mingled with air, by means of a small silver syringe, like that of Anel, with a long tube bent at the end, and having an orifice at least one-quarter of a line in diameter. The syringe was to contain three-quarters of air and one-quarter of the solution, and the two, mingled together, were to be forced by a quick descent of the piston into the glottis, in the form of a fine shower. A convenient plan, proposed by Mr. Cusack, of Dublin, is to sew a small piece of lint to the end of the finger of a glove, and, having fixed this upon the right fore-finger, to moisten the lint with the solution, and bring it into contact with the glottis. In whatever mode applied, the solution occasions a violent paroxysm of coughing, and sometimes even vomiting, which, however, subside in a short time without serious consequences. To decompose the portion of nitrate which may not unite immediately with the tissues, it is recommended to rinse the mouth and throat with a solution of common salt, of which the patient may also swallow a portion. The powders above mentioned may be applied by means of a tube, into which they have been introduced, and through which, placed deeply in the mouth with one end projecting, the patient should be directed to inspire forcibly.

Dr. Horace Green, of New York, applies a strong solution of nitrate of silver directly to the laryngeal mucous membrane, and with the best results. He employs a solution of the crystallized nitrate, of the strength of from two to four scruples of the salt to a fluidounce of distilled water, and makes the application by means of a piece of curved whalebone, with a sponge attached to the end of it, as recommended by M. Trousseau. Before attempting to penetrate the glottis, he accustoms the membrane to the irritant impression by applying the solution daily, for several days, to the parts immediately about the opening. When the sensibility of the lips of the glottis is thus somewhat blunted, he passes the sponge, saturated with the solution, through and debility. The system is too feeble to recover from the blow which it has received, and, unless supported by appropriate treatment, sinks into a dangerous or even fatal exhaustion. The grade of action throughout the complaint varies much. Generally it is sthenic, with a strong, full pulse, and bears depletion well. Occasionally it is low or asthenic, in consequence of the peculiar state of the constitution, or peculiar influences of a depressing character to which the patient may be subjected. This distinction is occasionally important in practice.

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* The proportions employed by Trousseau were subnitrate of bismuth undiluted; calomel with twelve parts of sugar; red precipitate, sulphate of zinc, and sulphate of copper, with thirty-six parts; alum with two parts; acetate of lead with seven parts; and nitrate of silver variously with twenty-two, thirty-six, and twenty-four parts. (*Dict. de Méd.*, xvii. 566.)

In the grades of bronchitis above described, the disease is very seldom fatal, unless in old persons, or in those debilitated by chronic complaints, in whom there is insufficient strength to throw off the copious bronchial secretion, which, therefore, overwhelms the lungs, and literally drowns the patient. But cases of a much severer and more dangerous character are not unfrequently met with. In those already treated of, the inflammation is comparatively moderate in degree, and confined chiefly to the larger tubes. In those now alluded to, the inflammation is more intense, sinks more deeply into the bronchial membrane, perhaps even to the sub-mucous tissue, or penetrates further into the tubes, so as even sometimes to reach their ultimate ramifications. In these cases, without a materially greater amount of pain or soreness, there is much greater oppression and difficulty of respiration. When these arise from mere intensity of inflammation, the air sometimes enters with difficulty through the thickened or contracted tubes, producing a blowing sound audible at a considerable distance; and the patient suffers with feelings of impending suffocation. When the cause of difficulty arises from the extent of the inflammation, respiration is hurried, the dyspnœa extreme, the pulse exceedingly frequent, and the general strength speedily exhausted. This condition of the disease is most common in infants, and is sometimes quickly fatal. Occasionally, in these severer forms of bronchitis, the attacks of dyspnœa are exceedingly sudden and violent, destroying life in the paroxysm unless relieved. The expectoration is sometimes thick and glutinous, even at the beginning, more like the adhesive secretion of pneumonia than the mucus of ordinary catarrh. It is also occasionally fibrinous, and small quantities of false membrane are coughed up with the mucous secretion. The danger may arise partly from the shock of the inflammation upon the nervous system; but much more commonly it proceeds from the interference of the disease with the access of air to the cells, and consequently with the due aëration of the blood. Dark blood, therefore, flows through the arteries, and produces its depressing effects upon the brain and all the dependent functions. The face becomes pale, or somewhat livid or purplish, the surface cool, the pulse frequent and very feeble, the dyspnœa excessive, and the countenance expressive of great anxiety. The vital powers give way, the skin is cold and clammy, the patient complains of intense thirst, and death soon takes place, preceded by coma, delirium, or convulsions. Those who most frequently perish of this disease are the very young, and the old and debilitated. The swelling of the tubes, and the secretion into those of smaller dimensions, cause an obstruction to the entrance of air, which the feeble muscular power of the patient is unable to overcome. Sometimes it is the blocking up suddenly of one of the larger bronchia which supplies a considerable portion of the lung, that occasions sudden death. Besides, the bronchitis not unfrequently becomes complicated with pneumonia, which greatly increases its danger.

An occasional variety of bronchitis is one in which the inflammation is obviously accompanied with spasm of the bronchial tubes. Paroxysms like those of spasmodic asthma come on at irregular periods, and threaten the patient with immediate suffocation. In other respects, the cases do not differ from the forms of the disease above described.

In its mildest form, acute bronchitis is a very slight disorder, commonly called a *cold*, or a *cold in the breast*. It usually comes on with a little hoarseness, followed by a moderate cough, and slight feelings of heat or soreness in the chest. The cough is at first dry, but is soon attended with expectoration, and then gradually subsides, causing little inconvenience to the patient, and seldom requiring the interference of the physician. Between this form of the disease, and the higher grade next to be described, there is every shade of difference.

A common form of bronchitis is one formerly known as *catarrh fever*, and still frequently so called. Beginning with coryza, sore-throat, or hoarseness, and sensations of lassitude, weariness, aching in the limbs, and chilliness, followed by febrile reaction, it soon exhibits the characteristic signs of bronchial inflammation. There is a feeling of diffused heat and uneasiness in the upper and anterior part of the chest, and often of tightness, stricture, weight, or soreness, but without acute pain, unless sometimes in coughing. In severe cases, these sensations are distressing, and attended with feelings of oppressed breathing, and occasionally with some difficulty of inspiration. Cough is usually among the first, and soon becomes one of the most prominent symptoms. It is at the commencement short and dry, or accompanied with but a slight expectoration; and is often very painful, producing sensations as of scraping, tearing, or rending, behind the sternum. It has some tendency to occur in paroxysms, especially in the morning after waking, when a little viscid mucus is occasionally discharged with temporary relief. At this stage, the patient is usually affected with frequency of pulse, heat and dryness of skin, flushed face, headache, furred tongue, scanty and high-coloured urine, sometimes nausea or vomiting; in short, with all the symptoms of fever. There is generally a remission of fever in the morning, and an exacerbation in the evening. In some rare instances, the symptoms above enumerated gradually subside, without any material increase of the bronchial secretion; but, in the great majority of cases, after a duration of from some hours to two or three days, the patient begins to expectorate a transparent, ropy, and often frothy mucus, of a saline taste, and sometimes streaked with blood, which is thrown up with painful, and occasionally almost convulsive coughing. This expectorated matter gradually increases in quantity, and at the same time in consistence, and, instead of being colourless and transparent as at first, becomes opaque and white, and ultimately yellowish or greenish, and at the same time quite bland to the taste. Sometimes this altered secretion is mixed with the thinner transparent matter, at others is exclusive. Along with the change in the mucous secretion, there is usually an amelioration of the other symptoms. The cough is easier, the soreness and tension are diminished, and the fever abates. In some instances, after such an amendment, the mucous discharge again becomes thinner and more transparent, and the symptoms generally undergo a corresponding change for the worse, indicating a temporary increase of the inflammation. At length, however, the disease gives way; the expectoration becomes free, and easy, with an opaque, often puruloid discharge; the skin becomes moist; the urine is increased in quantity; the fever subsides; and the patient returns gradually to health, but often with a slight cough, which remains for a considerable time. The attack varies in duration generally from four to ten days, though it sometimes runs on for two or three weeks, and sometimes assumes the chronic form. When the patient recovers, with a cough remaining, he is liable to relapse from slight causes. Occasionally, after the subsidence of the acute symptoms, a condition is left approaching in character to hectic, with frequent pulse, copious purulent expectoration, night sweats, emaciation, and debility. The system is too feeble to recover from the blow which it has received, and, unless supported by appropriate treatment, sinks into a dangerous or even fatal exhaustion. The grade of action throughout the complaint varies much. Generally it is sthenic, with a strong, full pulse, and bears depletion well. Occasionally it is low or asthenic, in consequence of the peculiar state of the constitution, or peculiar influences of a depressing character to which the patient may be subjected. This distinction is occasionally important in practice.

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There is another variety, in which, instead of mucus, or in connexion with it, coagulable lymph is secreted upon the inner surface of the bronchia, forming tubes of false membrane, which greatly obstruct the passage of air. This happens chiefly in infants, constituting a feature in the worst forms of croup. (See *Croup.*) It is exceedingly rare in adults, perhaps almost never occurring in them to any great extent. Occasionally, in persons of full age, a small portion of one of the bronchia becomes thus affected, and fibrinous tubes are expectorated with complete relief to the symptoms. There is not necessarily, in these cases, any considerable amount of constitutional disturbance. Indeed, the disease is sometimes of so limited an extent as not even to occasion fever. The patient is harassed with an obstinate cough, perhaps spits up blood consequent upon a partial separation of the false membrane, and some time later, after severe efforts, expectorates the offending cause.

Bronchitis is sometimes complicated with bilious and gastric symptoms, such as a yellow tinge of the eyes and skin, a loaded tongue, nausea or vomiting, and tenderness in the epigastrium and right hypochondrium. These may arise from portal congestion, gastric or hepatic inflammation, or from the influence of miasmata, adding remittent fever to the bronchial disease.

When bronchitis invades the smaller tubes, it has a strong tendency to pass into the air-cells, especially in infants, and thus to constitute pneumonia. It is not always easy to determine the limits between the two affections; nor is it a point of much practical importance; as their treatment in these situations is essentially the same. Pneumonia may always be suspected in bronchitis, when, along with the loose fluid secretion of the latter complaint, the tough, rusty-coloured, yellowish, or greenish, adhesive matter, characteristic of the former, is thrown up.*

Under the names of *peripneumonia notha*, *suffocative catarrh*, and *catarrhus senilis*, affections have been described by practical writers which have not always been sufficiently defined; and it is probable that very different diseases have sometimes been confounded; such, for example, as congestion or apoplexy of the lungs, pneumonia supervening upon old catarrhs, and proper bronchitis. There is a condition of the last mentioned disease, which may be considered perhaps as representing the greater number of these cases. It is characterized by the sudden occurrence of dyspnœa, often in paroxysms, with a copious and early secretion of mucus, and consequent wheezing respiration. The patient speaks with difficulty, is often unable to lie down, gasps for breath, and coughs violently and incessantly to free the lungs from the matter which threatens to overwhelm them. The expectoration, if not free at the onset of the disease, soon becomes abundant, and is frothy from the violence of the cough. It is sometimes also tinged with blood. An almost universal mucous rale may be heard over the chest, while percussion is occasionally dull in some parts, in consequence of the accumulation of mucus, or the existence of pulmonary congestion or collapse. Febrile symptoms sometimes appear at the commencement; but they do not usually continue long. Those consequent upon deficient aëration of the blood soon occur, and are very striking. The face is pale or livid, the lips are purple, the extremities cool, and the circulation very feeble. The disease is very dangerous, the more so as it has a tendency to run into pneumonia. But its fatality is owing chiefly to the circumstance of the previous bad health of the patient, who, long balanced between life and death, is precipitated by comparatively slight causes to the fatal issue. The sudden inability of even a small portion of the lungs to perform its duty, in consequence either of congestion, mucous accumulation, or the obstruction of one of the larger bronchial branches by a clog of concrete matter, is thus sufficient to endanger or destroy life.

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* The microscopic appearance of the expectorated matter varies with the degree, seat, and stage of the inflammation. In the earlier stage, and in mild cases, it differs little from that of healthy mucus, showing effete epithelial cells with their cilia, mucous corpuscles which are epithelial cells in different stages of developement, patches of adhering cells, and others of basement membrane with attached nuclei, all of which are contained in a transparent liquid. In severer cases, when the whole thickness of the mucous membrane may be supposed to be affected, there are in addition irregular masses of fibrinous exudation, with fibrils and exudation corpuscles in different stages, and, if the small tubes have been affected, minute cylindrical casts of fibrin. At a later stage, pus corpuscles are intermingled with the other ingredients, and increase until they become the prominent constituent. These are probably the result of the degradation of the mucous and exudation corpuscles. Besides these, crystals of uric acid and oxalate of lime have been noticed, with urate of ammonia, and amorphous sulphate of lime. (C. Black, *Ed. Month. Journ. of Med. Sci.*, vii. 294, 297, &c.) The first transparent mucus of bronchitis would appear to be the result of a more rapid formation of epithelial cells with their liquid product; the white opacity which follows may be ascribed to the abundance of undeveloped cells or mucous corpuscles, which are produced and thrown off under the excitement of the inflammation; the greater tenacity and dusky hue frequently noticed evince the presence of fibrinous exudation, resulting from a higher grade or deeper seat of the inflammation; while the gradually increasing yellowness of the sputa, as the affection advances, is owing to the formation of pus, consequent on the failing vital forces of the tissue. (*Note to the fourth edition.*)

Physical Signs.—The characteristic signs of bronchial inflammation are clearness upon percussion in all parts of the chest, sometimes diminishing a little as the disease advances; the dry or sonorous and sibilant rales in the earliest stage; afterwards the moist or mucous rales more or less mingled with the dry; and the respiratory murmur still audible, though frequently weakened, especially when the disease is seated in the smaller tubes. It is not in every case of bronchitis that the dry rales are heard; for not unfrequently the disease is so mild as not to produce sufficient narrowing of the tubes to give the requisite physical condition for these sounds. Nor are the two sounds heard always under the same circumstances. Both arise from the diminished caliber of the bronchia, consequent upon inflammatory thickening or exudation, or spasmodic constriction. But the sonorous rale is heard in the larger, and the sibilant in the smaller tubes. It sometimes happens that the caliber of one of the larger bronchia is so much contracted as to occasion the hissing or whistling sound; and this may be known by the persistence of the sound during the whole period of inspiration and expiration; for in the small tubes the air is not so long in its passage as in the larger; but, generally speaking, when the sibilant rale is heard, and especially when it extends over a large surface, the evidence is strong that inflammation exists in the small tubes. According to the extent of the chest over which these sounds prevail, is in general the extent of the inflammation; but it must be borne in mind that the sonorous rale, from its loudness, may often be heard at a considerable distance from its actual seat, sometimes even over the whole of one side of the thorax; and, if any part of the lungs is consolidated by pneumonia, all the rales, whether dry or moist, may be conducted to the ear from a considerable distance. There is always great reason for apprehension, when the hissing sound, as sometimes happens in infants, is audible over a great portion of the chest.

The dry rales are seldom entirely pure, even when first distinguishable by the ear; as secretion generally begins before the membrane has become so thickened as to cause them. Occasionally, however, they are so; and it is asserted that they have continued two or three days without admixture of the mucous rales, and that they have even subsided altogether without the occurrence of the latter sounds, or of expectoration. In the great majority of cases, there is, almost from the beginning, more or less of the mucous bubbling or crepitation; and it is only the predominance of the dry sounds that determines the stage of the disease. Not unfrequently, the mucous rale ceases for a time after expectoration. At length, when the stage of secretion is fully established, the moist sounds predominate, though the dry are still frequently heard. All of them are variable, often shifting about from one part of the chest to another, with the varying condition of the tubes and the secretion.

The moist sounds themselves vary according to the size of the tubes, and consequently of the bubbles formed in them. The mucous rale is perceived in the larger, the subcrepitant in the smaller. When, therefore, the fine crepitation of the latter is observed, and especially if in connexion with it is the sibilant rale, the evidence is conclusive that the disease is seated in the smaller bronchial ramifications; and, should the respiratory murmur be superseded by these sounds, it would be inferred that the disease is very extensive. Under such circumstances it might be difficult to distinguish bronchitis from pneumonia, especially if some congestion of the lung, producing a degree of dulness on percussion, were connected with the former; but the absence of the crepitant rale, of the rusty sputa, of bronchial respiration, and of bronchophony, and the temporary duration of the dulness, would be sufficient to prove the absence of pneumonic inflammation. Sometimes the mucus is so thick and tenacious, in the advanced stages of bronchitis, as to narrow the passage by adhering to the sides of the tubes, and thus to occasion the sonorous and sibilant rales; which, however, under such circumstances, cease after coughing. Such a condition of the mucus occasions also a sort of ticking sound, in consequence of the greater tenacity and consequent less frequent rupture of the bubbles.

An important point among the physical signs of bronchitis is, that the respiratory murmur, though usually heard over the whole lung, yet sometimes ceases to be audible in one or more parts, thus leading to the suspicion that consolidation of the lung has taken place from inflammation or other cause. But percussion relieves the apprehension by proving that the part affected continues sonorous, and consequently contains air. The phenomenon is owing to the obstruction of one of the bronchial tubes by a plug of mucus, or by inflammatory thickening. In the former case, it is often removed by coughing, which displaces the obstruction, and allows the air again free admission and exit. Dr. Gairdner has shown that, as a consequence of obstruction in the bronchial tubes in bronchitis, a collapse of that portion of the lung supplied by the tube affected is not unfrequent; giving rise of course, when extensive, to more or less dulness on percussion, as well as to absence of respiration.

Anatomical Characters.—The bronchial mucous membrane is reddened, thickened, sometimes softened, occasionally rough and destitute of its natural polish, and, in some very rare cases, ulcerated or gangrenous. The redness is sometimes diffused, but more frequently in patches, points, streaks, or arborizations. In slight cases, the redness is often confined to the larger bronchia; in the severer, it extends into the smaller ramifications. Under the microscope, the surface of the membrane may sometimes be seen deprived of its epithelium, and the fibrous layer covered with a fibrinous exudation in place of it. The tubes contain mucus in various states, sometimes blood, and not unfrequently pus. In cases which appear to have proved fatal from the abundance of the undischarged secretion, the lungs refuse to collapse upon the admission of air into the pleural cavities. The bronchia are sometimes dilated.

Dr. Gairdner, of Edinburgh, has demonstrated that, in certain cases of local condensation of lung in the adult, previously ascribed to limited inflammation of the pulmonary tissue, the result is in fact owing to collapse of the air-cells, consequent on the obstruction of the bronchial tubes leading to the parts affected, and that the phenomenon is one not of lobular pneumonia, but of bronchitis. The same observation had been previously made by MM. Bailly and Legendre in relation to the supposed lobular pneumonia of infants. The state of the lung is similar to that imperfect expansion of the lungs of newborn infants, denominated *atelectasis*. This seems to be proved by the fact that, in cases of such condensation, before the parts have become altered in structure by length of time, the portion of lung affected can frequently be restored nearly to its natural condition by forcible inflation. Dr. Gairdner describes two conditions of this collapse, one *diffused*, and the other of the *lobular form*. In both, the colour is usually of a dark violet on the surface, and brownish-red within; the crepitation is diminished or quite lost; and, when the collapse is complete, portions are found to sink readily in water. The cut surface is nearly smooth, having somewhat the appearance of muscular flesh, and without any trace of the granular aspect characteristic of the hepatization of pneumonia. In the *diffused variety*, the state of collapse may affect considerable portions of one or both lungs, especially the posterior part, and gradually passes into the healthy structure; in the *lobular*, the condensed part has an abrupt boundary, being accurately limited by the interlobular septa. These collapsed portions may have been affected with bronchial inflammation, in which case small abscesses may sometimes be observed in them, from the size of a hemp-seed to twice or three times the volume, bearing when incised no inconsiderable resemblance to softening tubercle. These are lined with false membrane, and communicate with the bronchial tubes. Dr. Gairdner considers them as strictly bronchial, but they probably arise from distension of the air-vesicles with pus. They sometimes occur in adults; but are more frequent in infants, being a common attendant on acute infantile bronchitis of a severe character. (See *Ed. Monthly Journ. of Med. Sci.*, Aug. & Sept. 1850.) Dr. Gairdner ascribes this local collapse of the lung in bronchitis, partly to an excess of the expiratory over the inspiratory power, which causes the air to be expelled with greater force than it can enter through the impediment in the bronchia, partly also to the mechanical action of the plug of mucus, which with the inspiration is forced into a constantly diminishing passage, and with the expiration into one constantly enlarging, so that air necessarily passes outward more readily than inwards. The latter is probably the true cause. The collapse, if permanent, is followed by atrophy of the part, which leaves in the place of pulmonary structure, nothing but a little fibrous tissue with specks of carbonaceous matter.

Causes.—Cold is beyond all comparison the most frequent cause of bronchitis. It is most apt to produce the disease when applied partially to some one portion of the frame, as to the back of the neck, feet, &c., or to the body previously heated by exercise, and in a state of perspiration; and it is always most injurious when combined with moisture. The disease appears sometimes to result from reaction in the bronchial mucous membrane, upon entering a heated apartment after having breathed an intensely cold air. It is most frequent in the latter part of autumn, in winter, and spring, when the atmospheric changes are frequent and great, and the air is often loaded with condensed moisture. But it occurs from the same cause in summer, and sometimes, when protracted, ceases upon the occurrence of the clear cold weather of winter.

Other causes are heated air, acrid gases or vapours, and irritating powders inhaled into the lungs. In some persons, the disease is produced by peculiar exhalations which do not affect men in general. Thus, the powder of ipecacuanha occasionally excites violent bronchial inflammation when inhaled. English writers speak of a peculiar catarrhal affection, called in Great Britain "*the hay asthma*," which occurs in some susceptible individuals about the period of mowing in May and June, and is ascribed to the exhalation from a certain kind of grass when cut. The complaint is often very severe, involving the whole of the air-passages, and requiring removal from the sphere of the supposed cause in those exposed to its attacks. Only a few comparatively are liable to it.

Bronchitis occurs periodically in some individuals once a year, and at the same time of the year, without any assignable cause. Among my patients, for a long time, was an elderly gentleman, who was attacked with the disease regularly at a certain time in August. He resided in the city of Philadelphia, and, so far as could be learned was never exposed at that season to the influence of any peculiar cause. He died ultimately of phthisis at an advanced age, and had probably for thirty years been subject to occasional attacks of hæmoptysis. Two other persons, of gouty families, have occasionally consulted me for a similar affection, occurring about the same time every summer. I think it not improbable, that such cases are often gout affecting the respiratory passages.

Epidemic influence is a powerful and not unfrequent cause of bronchitis. (See *Influenza.*)

The disease is a frequent attendant upon many other complaints, as measles, smallpox, scarlet fever, hooping-cough, asthma, enteric or typhoid fever, and acute inflammation of the lungs, pleura, pericardium, and liver. It also affords us one of the first intimations of the deposition of tuberculous matter in phthisis.

Treatment.—In the very commencement of one of these bronchial affections, while there is yet but a slight coryza, soreness of throat, or hoarseness, and the irritation is but just beginning to show itself in the chest, the disease may often be entirely subverted by a dose of opium at bedtime, a copious perspiration induced by hot teas or strenuous bodily exertion, or even by a full supper of stimulating food and drink. But it is only in cases where previous experience justifies the apprehension of a severe attack from these slight beginnings, that such treatment would be desirable; and the stimulating plan is altogether too hazardous for ordinary use, as, if it fail, it will be liable greatly to aggravate the subsequent symptoms. For further particulars the reader is referred to the subject of coryza. (See *page* 774.)

In a mild case of bronchitis, with little or no fever, nothing more is required than a saline cathartic, confinement to the house, a vegetable diet, demulcent drinks, and small doses of one of the antimonials. I usually direct an adult patient, after having been purged by an ounce of sulphate of magnesia, to drink daily, in small portions at a time, a pint of flaxseed tea with two fluiddrachms of antimonial wine. Other demulcents may be employed if preferred by the patient; as solution of gum arabic in the proportion of an ounce to the pint, infusion of slippery elm, decoction of marsh-mallow, and decoctions of the dried fruits, sweetened and flavoured with lemon or orange-juice. To allay the cough, demulcent substances may be held in the mouth, and swallowed as they slowly dissolve. Such are gum arabic, liquorice, jujube paste, solidified molasses, and gum pectoral, consisting of a mixture of gum and sugar dissolved together and evaporated.

Should considerable fever exist along with the pectoral symptoms, the patient ought to soak his feet in hot water, go to bed, and take every two or three hours a dose of the neutral mixture, effervescing draught, solution of acetate of ammonia, or nitre, with a small proportion of tartar emetic, or one of the liquid preparations of ipecacuanha. In infantile cases in which the nervous system is often disordered, spirit of nitric ether may be added to the diaphoretic medicines. The air of the room should be kept warm, and the patient should use his voice as little as possible.

When there are headache, oppressed breathing, and considerable pain or soreness in the chest, or any one of these symptoms, in a high degree, along with a strong and excited pulse, blood should be taken from the arm, to the amount, in robust persons, of sixteen ounces; but generally less bleeding is required than in the serous inflammations, and the great majority of cases do very well without it. Occasionally, but not often, the bleeding may be repeated. In relation to the loss of blood, it is highly important to have reference to the constitution of the patient; and the discharge should always be stopped, however little may have been lost, when the pulse begins to fail. In feeble patients, it is of the utmost importance to reserve sufficient strength for the expectoration of the pulmonary secretion. When bleeding is of doubtful propriety, should the local inflammation seem to call for depletion, leeches or cups should be applied to the breast or between the shoulders, or wherever the sibilant rale may be most heard; and, in all cases, these are admirable adjuvants to the lancet. Sometimes, when there is considerable debility, dry cups may be applied with benefit.

In severe cases, a full purgative dose of calomel should be given at first, and followed by depletion and diaphoretics as above. Some advise, as an adjuvant to the lancet, or as a substitute for it in cases in which it may be of doubtful propriety, tartar emetic in doses as large as can well be tolerated by the stomach without emesis, as one-quarter, one-third, or one-half of a grain, every hour or two.

When the first violence of the inflammation is over, remedies should be given calculated to favour the expectoration. Squill or seneka in connexion with tartar emetic, ipecacuanha, or sanguinaria, are now suitable remedies. Some strongly recommend also the alkaline carbonates, as having the property of thinning and rendering of easier expectoration the viscid bronchial secretion. I have little confidence, however, in the latter remedies. It is more desirable to associate with the expectorants, substances calculated to allay the cough and quiet restlessness. Opium, however, which, under favourable circumstances, is best adapted to these ends, cannot be used with propriety in this stage of bronchitis, at least as a general rule, in consequence of its ordinary effect of restraining mucous secretion, and therefore of shutting up the inflammation in the membrane. Recourse, then, may sometimes be had, where the cough is peculiarly violent, to the preparations of hyoscyamus, conium, or hydrocyanic acid. Either of these medicines may be advantageously given in liquid mixtures, along with some demulcent substance, as liquorice, gum arabic, or sugar. Every practitioner can make a cough mixture out of these materials to suit his own views, and the circumstances of the case. It is generally preferable to employ the liquid preparations of the medicines recommended, as the syrup of squill or seneka, the wine or syrup of ipecacuanha, and the tincture of sanguinaria. Tartar emetic may be used in aqueous or vinous solution; and the narcotics in the form of tincture or extract. The proportions should be so arranged that a dose may be given every two, four, or six hours, according to the urgency and acuteness of the symptoms.*

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* A mixture may contain in each dose, for an adult, from ♏x to fʒss of Antimonial or Ipecacuanha Wine or Tincture of Sanguinaria, or from fʒss to fʒj of Syrup of Ipecacuanha; combined with from ♏xx to ♏xl of Syrup of Squill, or ♏x to ♏xx of Vinegar or Tincture of Squill, or from fʒss to fʒj of Syrup of Seneka; and with from fʒss to fʒj of Tinct. of Hyoscyamus or Conium, or ♏ij to ♏iv of Officinal Hydrocyanic Acid. In cases suitable for opiates, for the above narcotic tinctures may be substituted, in each dose, from ♏ij to ♏iv of Laudanum, ♏xv to fʒss of Solution of Sulphate of Morphia, or fʒss to fʒj of Camphorated Tincture of Opium. It will be convenient to prescribe these medicines in a mixture of f℥vj, with ʒij of Gum Arabic, and ʒij of Sugar or Liquorice, in such quantities that a tablespoonful of the mixture shall contain the doses above mentioned.

After expectoration has been fairly established, opiates come in with great propriety, and not only add vastly to the comfort of the patient, but tend to promote a cure. The salts of morphia are probably preferable to any other preparations of opium in cough mixtures, from the circumstance that they tend less to restrain the secretions. The camphorated tincture, or paregoric, which is much employed both popularly and by physicians, is less suitable to acute than to chronic cases, in consequence of its stimulating properties. The opiate may in general be most conveniently administered, in small doses, in connexion with the expectorant mixtures. Sometimes, when the cough is very troublesome, and productive of wakefulness at night, the opium is best given in full doses at bedtime, conjoined with an equal or double weight of ipecacuanha.

Should bronchitis be indisposed to yield to suitable depletion, and the symptoms be of an urgent character, there should be no delay in resorting to mercury, with a view to its peculiar influence on the system. It may also be used, with great advantage, in some dangerous cases, in which the debility of the patient may contraindicate the lancet.

In the advanced stage of the disease, when it appears to be verging to a chronic form, I have found nothing so effectual, with the exception of mercury, as a decoction of seneka with tartar emetic. An ounce of the bruised root, and the same quantity of liquorice root, may be boiled in a pint and a half of water to a pint, and one grain of tartar emetic, and an ounce or two of sugar, added to the decoction. The dose is a tablespoonful every two hours, or a wineglassful, if the patient's stomach will bear it, twice or three times a day. I prefer the former mode of exhibition. The compound pills of squill, consisting chiefly of squill and ammoniac, are also an excellent remedy. Assafetida is capable of doing great service in certain cases, especially in infants, in whom the nervous actions are often irregular, and the system needs support, under the exhausting action of the disease. When there is considerable debility with difficulty of expectorating the bronchial secretions, carbonate of ammonia, in doses of three or five grains every hour or two, often answers an admirable purpose.

Local measures are also important. After the application of cups or leeches, in severe cases, large emollient poultices are often useful, kept steadily applied for days together. After due depletion, sinapisms and blisters are highly beneficial. The latter are, indeed, among the most effectual means that can be employed at a certain stage. Very early in the disease, they often fail to arrest the inflammation, while they aggravate the fever. It is after the violence of the diseased action has begun to subside, that they are most usefully employed. In this condition of the disease, they sometimes put an immediate end to it. Occasionally, in very threatening cases, when a very speedy action is required, the strong solution of ammonia may be employed as a rubefacient and vesicatory. In mild cases, especially in children, rubefacient liniments, made of solution of ammonia or of oil of turpentine, mixed in various proportions with olive oil, with the occasional addition of tincture of camphor, and certain aromatic oils, as those of rosemary, origanum, and horsemint, are sometimes preferable to blisters. Towards the period of convalescence, plasters of Burgundy or Canada pitch, or the warming plaster, may hasten perfect recovery, and guard against relapse. Inhalation of the vapour of hot water, is recommended by some writers as a kind of emollient application to the inflamed surface; but I believe that it will be found to aggravate, quite as frequently as to alleviate the discomfort of the patient. It is probably better applicable to cases complicated with spasm of the bronchia, than to pure acute inflammation.

There is a point in the progress of some cases of acute bronchitis, when it becomes highly important to abandon all depletory methods, and resort to a supporting treatment. The pectoral stricture and pains have ceased, expectoration has been fully established, the skin has become soft or moist, and the matter discharged has assumed an opaque and perhaps puruloid appearance; but the cough continues severe and harassing, the pulse is often frequent, and the patient suffers greatly from feelings of debility and general uneasiness. Every experienced practitioner must have seen such cases recover rapidly, as if by a charm, under a nutritious diet, a little malt liquor or wine, and exercise in the open air. When purulent expectoration, night sweats, and a hectic circulation are observed, there should be no hesitation in resorting to tonics, among which sulphate of quinia is the most efficient. Should this produce constriction of the chest, the infusion of wild-cherry bark should be substituted, with the addition of one of the mineral acids.

Throughout the case, the patient should avoid speaking long or loudly, should wear flannel next the skin, and should not expose himself to vicissitudes of temperature.

Certain special cases require, in some degree, special modes of treatment. In infants, leeching is often in the highest degree efficient, emetics are sometimes beneficial, and the warm bath proves a useful adjuvant. Full purgative doses of calomel, too, frequently produce in children the happiest effects. In the advanced stage of the disease, when the strength begins to fail, the respiration to become hurried, and the nose and cheeks to feel cool to the hand, assafetida produces immediate amendment, and sometimes speedily rescues the little patient from great apparent danger. The syrup of onions, and the syrup of garlic, have the same effect in a less degree; and advantage sometimes accrues from applying garlic poultices to the feet, and bathing the chest with a tincture of the same substance made extemporaneously by heating it in brandy.

When the disease is seated in the smaller bronchia, and occupies a large portion of the chest, the treatment should be especially active. General and local bleeding pushed as far as the strength will permit, free and early blistering, and the use of mercury, are the chief remedies.

When the inflammation is complicated with spasmodic paroxysms of an asthmatic character, emetics of ipecacuanha during the paroxysms, and the steady use of tincture of lobelia, in such doses as slightly to nauseate without vomiting the patient, will be found highly useful additions to the ordinary antiphlogistic measures. Tincture of lobelia and syrup of seneka answer well together in such cases.

In relation to the variety of bronchitis called in Great Britain the *hay asthma*, independently of the measures ordinarily employed in catarrhal affections, Mr. Gordon, who appears to have paid particular attention to the subject, states that he has found lobelia the most speedy and effectual remedy, and the cold shower-bath and a combination of the sulphates of quinia and iron the most effectual preventives. (*Watson's Lect. on Princip. and Pract. of Physic.*) Dr. Elliotson has obtained signal relief, in three out of four cases, by diffusing chlorine in the patient's apartment, by means of the chloride of lime or of soda, placed in saucers or other convenient vessel. (*Tweedie's Syst. of Pract. Med.*) The tincture of nux vomica, in the dose of ten drops, gradually increased to twenty, three times a day, has produced the best effects in the hands of Mr. Gream. At the same time he applies to the nasal membrane, as high up as possible, an ointment made by mixing a drachm and a half of solution of subacetate of lead with two ounces of spermaceti cerate, and a few drops of oil of bergamot. (*London Lancet*, June 8, 1850.) Dr. F. W. Mackenzie, of London, has found arsenic peculiarly useful, and gives the Fowler's solution in doses of from one to five minims. (*Lond. Journ. of Med.*, July, 1851.) In the catarrhal cases which occur regularly in the same individual, at the same time every year, I should expect benefit from colchicum.

When bronchitis is associated with hepatic disease, calomel should be early given as a purge, and the system brought quickly under the mercurial influence. If associated with miasmatic fever, especially in its intermittent form, it will generally yield to quinia, after due depletion.

The treatment adapted to the variety of the disease denominated *peripneumonia notha*, depends very much upon the strength of the patient. In vigorous individuals, and in cases not complicated with chronic disease, active depletion by the lancet and by local means should be employed. In the old and feeble, who are much more frequently the subjects of attack, blood must be taken cautiously; and more reliance should be placed upon cups or leeches, blisters, and expectorants than on general bleeding. The choice of expectorants will also be influenced by the symptoms; the antimonials and ipecacuanha being adapted to the more open inflammatory cases; squill, seneka, ammoniac, assafetida, and carbonate of ammonia, to those in which the bronchial secretion is too abundant, and the muscular powers of the patient too feeble for its expectoration. In intermediate cases, the two kinds of expectorants may be very properly combined.

2. CHRONIC BRONCHITIS.

Of chronic inflammation of the bronchia there are, perhaps, as many grades and varieties as of the acute. It often occurs in a very mild form, with no other observable symptoms than a slight cough and moderate expectoration, which, after lasting a considerable time, either gradually cease, or become aggravated so as to excite the solicitude of the patient. Such coughs are apt to diminish or disappear during the summer, and, when the predisposition is strong, to return again in the winter; and in this way they not unfrequently continue for many years, especially in elderly people.

Severer cases are not uncommon, in which there is a troublesome cough, usually attended with expectoration, sometimes scanty and difficult, sometimes easy and copious, of a thick, somewhat tenacious, opaque mucus, whitish, yellowish, or greenish, sometimes streaked with blood, and frequently mixed with larger quantities of a thinner and more transparent, ropy liquid, probably the result of more recent inflammation, either supervening upon the old, or occupying a different part of the lungs. In some instances, small, whitish, opaque, solid particles are mixed with the sputa, which have by some been considered as tuberculous matter, but which, according to Andral, are nothing more than the concrete secretion of mucous follicles in the fauces. In certain rare cases, the expectoration has a very offensive odour, referrible possibly to the condition of the blood. The cough is usually most severe, and the expectoration most abundant in the morning. It is occasionally attended with pain, soreness, heat, and some degree of tightness in the chest; but these symptoms are not common, unless as consequences of new accessions of inflammation. Sometimes the patient is affected with hurried respiration or dyspnœa, and these are much more apt than in health to occur after muscular exertion. In general, there is no fever; but it is not uncommon to find the pulse somewhat quickened; and sometimes a slight febrile paroxysm may be observed to form every day. The complaint may run on for a very long time with little modification, except, perhaps, a diminution in warm weather, which, indeed, not unfrequently co-operates with proper remedial measures in putting an end to it. Unless relieved, it is apt in time to take on the following more aggravated form.

Either as a consequence of an acute attack, or from the increase of a milder chronic form of the disease, the symptoms sometimes exhibit a formidable character. There is copious purulent expectoration, with occasionally a little blood, shortness of breath much increased by exercise, debility, emaciation, a frequent pulse, sweats at night, and, in fact, all the obvious symptoms of phthisis; so that the complaint was formerly, and is still occasionally denominated *catarrhal consumption*. Such cases not unfrequently terminate fatally, either by gradually wearing out the patient, or by the supervention of acute inflammation of the bronchia or other portion of the respiratory organs. In some instances, however, such acute attacks appear to supersede the chronic, and, if they do not carry off the patient, leave him better than they found him. When chronic bronchitis of this or the milder form has lasted for many years, it is sometimes dangerous to suppress it, especially in very old people. The system, so long accustomed to the discharge, cannot accommodate itself to the new condition consequent upon its cessation; and serious or fatal congestion or inflammation is apt to occur in some one of the vital organs.

Frequently, in the course of chronic bronchitis, there is a mixture of acute with the chronic symptoms, in consequence either of the supervention of fresh inflammation in the parts before inflamed chronically, or of new parts becoming affected; and this possible complication should always be borne in mind in the treatment. A test of the occurrence of acute symptoms, suggested by Andral, is the appearance of transparent, amidst, or in the place of previously opaque sputa. The sign is generally, but not universally true.

A variety of chronic bronchitis called by Laennec *pituitous catarrh*, by Williams *bronchorrhœa*, and by the older writers *humoral asthma*, is characterized by paroxysms of severe dyspnœa and coughing, followed by the copious expectoration of a ropy, glairy, transparent, and more or less frothy mucus, which has been compared to the white of egg beat with water, and allowed to stand. Several pints are sometimes discharged in twenty-four hours. The paroxysms occur daily, and, in some cases, several times a day, are exceedingly variable in their duration, are seldom accompanied with fever, and sometimes begin with coryza. Upon auscultation, the dry morbid sounds are first heard, which are very soon followed by the mucous rale, showing that the attacks commence with a congestion and consequent tumefaction of the mucous membrane, which is afterwards relieved by secretion. The chronic disease consists in a peculiar condition of the bronchia, which renders them liable to congestive attacks from slight irritation; while the tissue does not possess energy enough to take on acute inflammation. The complaint is apt to occur in old gouty individuals, and those labouring under chronic disease of the stomach, liver, and especially of the heart. It sometimes also attends the developement of miliary tubercles throughout the lungs. The paroxysms are induced by cold, irritating vapours or powders, and by other causes which ordinarily produce catarrh.

The disease is sometimes speedily fatal in old persons, who die in one of the paroxysms, suffocated by the excessive secretion which they cannot discharge. Generally, however, it continues for a long time, in some instances for many years, wearing out the strength of the patient, who is apt to become dropsical, and dies at length from exhaustion or suffocation. The excessive secretion sometimes relieves complaints of the heart by removing congestion.

Laennec describes, under the name of *dry catarrh*, a variety of chronic bronchitis, with a very troublesome cough, sense of oppression in the chest, and either no expectoration, or only of small, semi-transparent, pearl-gray pellets, of the consistence of pitch. A sibilant rale is heard. The disease is apt to attack the gouty and hypochondriac, the inhabitants of the sea-coast, persons subject to cutaneous diseases, and those enfeebled by excesses.

Physical Signs.—These are the mucous rales, occasionally mixed with the sonorous and sibilant, occurring in various parts of the chest, and often shifting. It is sometimes only by physical signs that the chronic catarrh can be distinguished from phthisis. The diagnostic symptoms of the former are equable resonance upon percussion, the absence of the signs of consolidation in any portion of the lung, as bronchial resonance and respiration, and of the signs indicating a cavity, as amphoric resonance or respiration, and pectoriloquy. When these signs are absent, and at the same time there is copious purulent expectoration, the evidence is almost conclusive that the disease is bronchial. But, when the bronchia are themselves much enlarged, and contain pus, it is sometimes difficult to make an accurate diagnosis. The signs, however, of preceding consolidation of the lungs, characteristic of ordinary tuberculous deposits, are wanting in this case. (See *Phthisis.*)

Prognosis.—In its worst forms, chronic bronchitis is a dangerous affection, though it often continues for many years, and is occasionally prolonged from middle life into an advanced old age. It is not so often directly fatal, as indirectly, by so far debilitating the system, and deteriorating the lungs, as to cause the patient to sink under the supervention of acute inflammation whether of the bronchia or other part of the respiratory apparatus. One of the first effects of these acute attacks is to produce a suspension or diminution of the discharge from the bronchia, which is, therefore, a bad sign in chronic bronchitis. Patients with this disease also frequently die of complaints of the heart, which are sometimes the cause, and sometimes probably the result of the bronchial affection. The coexistence of much enlargement of the bronchia with chronic inflammation is an unfavourable sign. The supervention of an attack of spasmodic asthma upon an old catarrh occasionally adds greatly to its danger. In determining as to the degree of danger from chronic bronchitis, it is very important to ascertain whether it may not be dependent upon some more serious disease.

Anatomical Characters.—The mucous membrane is thickened, sometimes partially indurated, sometimes, though rarely, softened or ulcerated, in some cases of a deep-red, violet, or brownish hue, in others grayish, whitish, or only of a slightly reddish tinge, and generally lined with puruloid mucus or well-formed pus. The extreme tubes are not unfrequently distended with the pulmonary secretion; and the bronchial glands enlarged and softened. In the dry catarrh of Laennec, the minute bronchial ramifications are reddened, and so much thickened as often to obstruct the passage, and, when this is not the case, are apt to be blocked up by a thick tenacious matter, in globules of the size of millet seeds. The tubes are occasionally found dilated, either singly or in numbers, sometimes throughout the whole extent of a branch and its ramifications, sometimes in isolated portions of the tube. In the former case, the parietes are generally thickened, and the result is probably owing to a kind of inflammatory hypertrophy; in the latter, they are thinned, sometimes very much so, owing, undoubtedly, to distension from the extraordinary impulse given to the air in coughing and respiration. Constriction of the tubes is sometimes observed, in such a degree as completely to close them, arising from thickening of the mucous membrane, or of the entire wall of the tube. In some cases in which all the signs of chronic bronchitis exist during life, the tubes are found to all appearance perfectly healthy after death. (*Andral, Bayle, &c.*)

Causes.—The greater number of cases of chronic catarrh are the consequences of acute attacks. But not unfrequently they come on gradually from the slight and continued or frequent application of causes of irritation, such as ordinarily produce the acute disease, when more intense, or acting on more susceptible subjects. Irritating powders are apt to produce this effect when inhaled; and hence, stone-cutters, workers in metal, and those employed to cleanse feathers, hair, &c., by beating them, are liable to the disease. There is a peculiarity, moreover, of constitution, which predisposes certain individuals to chronic bronchitis; and such a peculiarity often exists in persons of a rheumatic or gouty habit of system, and those subject to cutaneous eruptions. The disease is a frequent accompaniment of other pectoral complaints, especially phthisis, in which, when fully developed, it is never absent. Disease of the heart frequently causes it, in consequence of the irregular distribution of blood in the lungs which it produces, and, when not the cause, tends to aggravate the complaint, and to render it much more obstinate. It frequently follows measles and hooping-cough; and appears sometimes to depend upon the suppression of habitual discharges, especially the menstrual and hemorrhoidal.

Treatment.—General bleeding is seldom required or admissible, to any considerable extent. In some cases, when the symptoms, under temporary influences, assume a more acute character, a few ounces of blood may be taken with advantage from the arm; but it should always be done with caution. Local bleeding, by cups or leeches, is both safer and more efficacious. It may be resorted to occasionally, and in moderation, when there is some pain or stricture in the chest, with sufficient strength of pulse.

The expectorants are, upon the whole, the medicines best adapted to this complaint. In the choice of them, the practitioner must be guided by the symptoms. Should some excitement of the circulation exist, with deficient expectoration, and some degree of constriction, the least stimulating articles of the class should be used, such as tartar emetic in aqueous or vinous solution, ipecacuanha wine or syrup, tincture of sanguinaria and of lobelia, and wine of colchicum; of which a dose should be given four or six times a day, and so regulated as to be kept just within the nauseating point. If, as commonly happens, there is little or no evidence of general excitement, or active inflammation, one or more of the above-mentioned expectorants may be conjoined with syrup or tincture of squill, or syrup of seneka. I have found no combination so efficacious as the decoction of seneka and liquorice root, with tartar emetic, described under acute bronchitis. (See *page* 800.) It has happened to me to see many very obstinate cases of cough yield to this remedy. The seneka appears to exercise an alterative influence over the bronchial mucous membrane, independent of its expectorant power. The compound squill pill of the Pharmacopœia, containing chiefly squill and ammoniac, is an excellent combination. Recourse may also be had to the balsams of Tolu and Peru, the compound tincture of benzoin, and to copaiba. The last-mentioned medicine often proves serviceable in chronic catarrhs. The expectorants should generally be given in mixture, with small doses of one of the narcotics to allay cough. When there is tightness of the chest, and want of bronchial secretion, hyoscyamus, conium, stramonium, belladonna, or hydrocyanic acid should be preferred to opium; and camphor, in the form of tincture, or of camphor water, may sometimes be usefully added to the other ingredients. Under other circumstances, one of the opiates should be preferred, as more effectual than the medicines mentioned in allaying cough. The salts of morphia are probably the best preparations of opium for use in bronchial disease. The camphorated tincture of opium is a very agreeable preparation, well adapted to cases without any vestige of acute inflammation. Black snake-root, or cimicifuga, sometimes exerts a happy influence in the relief of chronic coughs. Sulphur, in the dose of half a drachm, or a drachm, two or three times a day, is also said to be useful. Cough mixtures of almost infinite diversity may be prepared from the above materials, in the choice and association of which the practitioner has ample opportunity for the exercise of a discriminating judgment. Gum arabic, liquorice, and sugar, are useful demulcent additions to the expectorants.

If the expectorant treatment fail, aided by local measures, such as will be detailed immediately, and should the case exhibit no peculiar tendency to tuberculous disease, recourse should be had to a mercurial impression, which should be maintained moderately for weeks, if not sooner effectual. For this purpose calomel or the mercurial pill should be employed; and advantage will often accrue from the addition of a narcotic, such as extract of hyoscyamus or conium, or opium with ipecacuanha when not contraindicated.

Should febrile action supervene upon chronic bronchitis, it may usually be relieved by a saline aperient, the neutral mixture, and tartar emetic in small doses.

External irritation should be sustained by blisters to the chest frequently repeated, pustulation by tartar emetic or croton oil, and setons or issues between the shoulders. To do permanent good, these must be long persevered in. The irritant should be applied as near as possible to the seat of inflammation, as indicated by auscultation. In mild cases, it may be sufficient for the patient to wear a plaster of Burgundy or Canada pitch, or a warming plaster. Frictions to the chest are also useful, and especially with rubefacient liniments, composed of some of the stimulating volatile oils, as of turpentine, rosemary, origanum, or monarda, sufficiently diluted with olive oil. When the disease is connected with a repelled eruption, it is important to endeavour to restore the cutaneous affection by irritation to the part in which it had previously existed; and croton oil is an excellent irritant for this purpose.

Inhalations are also very useful in some cases of chronic bronchitis. The vapours of tar are especially beneficial. The air of pine forests is thought to be peculiarly wholesome in this complaint. The fumes of common resin decomposed by heat have been employed with advantage. An ethereal solution of balsam of tolu has been recommended. Other substances, occasionally administered in this way, are chlorine and the vapour of iodine. The former may be breathed with the air in apartments, in which solutions of chloride of lime, potassa, or soda are placed; the latter is most conveniently applied by means of an inhaler, along with the vapour of water, and that of tincture of conium, hyoscyamus, opium, ether, or Hoffmann's anodyne.

In old or prostrate cases of chronic bronchitis, with copious purulent expectoration, night sweats, &c., it is in many instances highly important, in addition to the treatment above detailed, to employ measures calculated to invigorate the system. The chalybeates, combined with the bitter tonics, may be used, the former to improve the character of the blood, the latter to promote digestion. The infusion of wild cherry bark, long and freely used, is an excellent remedy under these circumstances; and may often be advantageously associated with one of the mineral acids, especially the aromatic sulphuric acid, or the nitro-muriatic. Decoction of Iceland moss has been much used, and it is said sometimes very efficaciously, as tonic, demulcent, and nutritive. Sulphate of quinia may be given when the disease is accompanied with chills and hectic paroxysms. Porter and other stimulant drinks must be called in requisition when the debility is great. Dr. Alison, of Edinburgh, has found great advantage from tannic acid, in doses of from one to three grains, two or three times a day. It diminishes the secretion and the cough, and increases the general strength. Should gastric or hepatic disease exist, the treatment must be modified accordingly, and, in cases of vomiting with gastritis, the stimulant plan should be suspended if possible. Exercise should be taken freely in warm dry weather; but exposure to cold and wet should be avoided. Hence the importance, if the patient be a resident of cold and austere climates, that he should remove during the winter to warm and equable latitudes. The interior of one of our most Southern States, or one of the West India islands, may be recommended. A sea-voyage is itself often beneficial, and, if long enough, will not unfrequently effect a cure. A change of residence, even without any considerable obvious change of climate, is sometimes beneficial. A resort to the Sulphur Springs may be advised, in the hope of good from their waters. Warm clothing, and flannel next the skin are important. Advantage will often accrue, during the severe cold of our winters, from wearing wadded cotton or lamb's wool over the breast or shoulders. General frictions to the surface are sometimes useful. The diet should vary with the circumstances of the case. Ordinarily, it should be nutritious without being stimulant, consisting, for example, of milk, the lighter meats in moderation, fish, farinaceous preparations, and vegetables. When there is any degree of acuteness in the symptoms, meats should be forbidden, and the patient confined to milk and vegetables, or the latter alone. Stimulating drinks should not be allowed unless in cases of considerable debility.

In the form of bronchial disease denominated *pituitous catarrh*, *bronchorrhœa*, or *humoral asthma*, the treatment should vary according as it is applied to the paroxysm or the interval. At the accession of the attacks, hot pediluvia, hot baths, sinapisms over the epigastrium, and, if the strength permit, an emetic of ipecacuanha, may be employed, followed by small doses of the same medicine or of tincture of lobelia, every hour or two, so as to sustain a slight nausea. During the excessive expectoration, stimulants sometimes become necessary to support the strength, and aid the patient in the discharge of the mucus. For this purpose, carbonate of ammonia, Hoffmann's anodyne, or sulphuric ether may be employed. Strong coffee has also been recommended. In the intervals, efforts should be directed towards obviating the tendency to bronchial congestion. The indication, therefore, is to sustain the tone of the bronchial vessels, and to maintain a moderate secretion from them. For this purpose, the stimulant expectorants already enumerated as remedies in chronic catarrh should be employed, and should be given with small doses of one of the preparations of antimony or ipecacuanha, or some other nauseating expectorant. Blisters to the chest are also useful. The functions should all be carefully attended to, and corrected if deranged. Disease of the liver and stomach, if existing, should be removed, the bowels should be kept regular, and gouty tendencies obviated by suitable remedies. In relation to diet, exercise, fresh air, an equable temperature, and warm clothing, the same remarks are applicable as to chronic bronchitis in general.

3. CATARRH.

This name was formerly applied to diseases of the mucous membranes generally, attended with increased secretion. At present, however, when not connected with some epithet fixing its locality elsewhere, it is confined to inflammation of the respiratory passages. Each portion of these passages

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4. INFLUENZA.

Syn.—Epidemic Catarrh.—Grippe (Fr.).

The name influenza, adopted from the Italian, has been applied exclusively, though with no great propriety, to an epidemic disease which usually takes on the character of catarrh. The first epidemic of this kind, of which we have any distinct medical record, occurred in the year 1510. There can be little doubt, however, that it has occasionally visited mankind from the earliest ages. Since the year mentioned, we have numerous records of its occurrence, at irregular intervals, down to our own times.

The epidemic appears to have been altogether irregular in the period of its recurrence. Sometimes returning in two or three years after its disappearance, it has, in other instances, postponed its return for seven, ten, or even twenty years. Nor does it appear to have observed any certain course in its progress. In general, however, its tendency is to proceed from the East towards the West, and it probably marches more frequently from the south northward, than in the contrary direction. On the old continent, it has sometimes commenced in Russia, advanced westward through Poland and Germany, then crossed into Britain, and afterwards visited successively France, Spain, and Italy. On other occasions, it has begun in the southeast, and entering France and Spain from Italy, has thence proceeded to England, and swept round the north of Europe. In this country, it has sometimes proceeded from the northern states towards the southern; on other occasions, has commenced in the latter, and marched towards the north. Its spread is usually so rapid, that it not unfrequently appears throughout vast extents of territory almost simultaneously. Oceans seem to oppose no obstacle to its course. It has leaped over from Europe to North America, has been observed in solitary islands in the midst of the ocean, and has attacked the crews of ships far out of reach of any communication from the land. It appears sometimes to have made the circuit of the whole globe. There is a considerable resemblance in its course to that of epidemic cholera, the march of which it has both immediately preceded and followed.

At the moment of invasion, it seizes almost simultaneously on great numbers, and before its departure sometimes involves almost the whole population. Its average duration, in each neighbourhood, is about six weeks; though the cause appears to linger after all the susceptible material for its action has been exhausted; for strangers arriving in the affected region, after the disease has apparently ceased, are not unfrequently attacked. The inferior animals appear to suffer as well as man. Many instances are on record, in which horses, dogs, sheep, and even birds have been seized by the epidemic. Some persons are much less susceptible to the morbid influence than others, and some appear to be altogether insusceptible. No obvious cause exists for this discrepancy. All ages, both sexes, and every variety of temperament and occupation, are equally liable to attack. It has been estimated that from one half to three quarters of the whole community are in a greater or less degree affected.

The disease exhibits, on the whole, a remarkable uniformity of character, though it has occasionally differed much in its grade of severity, in different times and places. In general it is very mild; but, on some occasions, and in certain localities, it has proved extremely fatal. Thus, during the epidemic of 1850, nine thousand persons are said to have died of the disease in Rome. It is probable that other epidemic influences may occasionally combine with and modify it in certain situations. It may, for example, be conceived that, if it should appear in a neighbourhood already tainted with a typhoid influence, this might fearfully increase the mortality.

In many of the epidemics, authors have recorded unusual changes in the temperature, moisture, and weight of the atmosphere; but the same state of the weather has not been observed in different places attacked; and not unfrequently there has been nothing uncommon noticed. It appears that the disease has prevailed in all climates, at all seasons, and in every possible thermometrical, hygrometrical, and barometrical variation. It has sometimes occurred in summer, though more frequently in the colder seasons.

Symptoms.—Influenza usually appears with the ordinary symptoms of catarrh, upon the whole, in a rather aggravated form. In many instances, however, it is very light, without fever, and scarcely regarded by the patient. It usually begins with coryza or sore-throat, and the common preliminary symptoms of fever, as feelings of lassitude and weariness, pains in the limbs, chilliness, rigors, &c., which are followed first by heat of skin, headache, and excited pulse, and soon afterwards by cough, uneasiness in the chest, and other signs of pectoral disease. But the symptoms of nervous derangement are in general much more prominent than in ordinary catarrh, and there is greater muscular debility. Disorders of sight and hearing, giddiness, pains in the back and limbs, general uneasiness, and depression of spirits are not uncommon in this disease. The headache is often severe, sometimes affecting equally the whole head, but more frequently concentrated in the forehead, and especially in the region of the frontal sinuses. Not unfrequently the pains extend to the back of the neck, in the form of rheumatism, and to the cheeks and temples, which are very sore and painful. Disorders of stomach, such as nausea and vomiting, are more common than in ordinary catarrh. But the most distinguishing feature of the disease is the debility which attends it. Almost all writers are agreed upon this point. In some of the epidemic attacks, it seems to have been less striking than in others, and in a few instances the pulse is said to have been strong, and to have not only borne, but imperiously demanded depletion. But, in the much greater number of instances, it is described as having been feeble; and in some, the debility was extraordinary, so that the disease would not at all bear the loss of blood, and death was in numerous cases ascribed to bleeding. So great was the prostration of strength, that the patient fainted merely upon attempting to sit up. Another striking circumstance is, that the debility often continued for a considerable time after the cessation of all other symptoms. I cannot say that I have observed this extraordinary debility in the epidemics which it has been my lot to witness; but the testimony to the fact is too strong and united to admit of denial. As in ordinary catarrhal fever, there is generally a remission of the febrile symptoms in the morning, and an exacerbation towards night. The degree of intensity in the nasal, throat, and pectoral symptoms is extremely variable. Sometimes the affection of the mucous membrane scarcely exceeds the point of irritation or congestion; and, even when the cough is considerable, auscultation does not always detect the signs of bronchial inflammation.

But the effects of this epidemic influence do not necessarily appear in the shape of catarrh. In some instances, its force has been spent upon the brain; and violent headache, flushed face, delirium, and fever have been the prominent symptoms. Sometimes the digestive organs have been affected, and the disease has been evinced chiefly by epigastric pain and tenderness, nausea, vomiting, &c. Occasionally it has appeared in the form of colic, diarrhœa, or dysentery, which have either existed alone, or as complications of the catarrhal affection, especially towards its close. Inflammations of the lungs, pleura, and pericardium have always been frequent during the prevalence of influenza, and have undoubtedly been dependent upon the same cause as that of the respiratory passages. Sometimes inflammation has appeared in these situations as an original affection, and sometimes as an attendant upon the bronchial disease. Abscesses of the frontal sinuses were noticed by Rush among the forms of influenza. Hæmoptysis not unfrequently occurs in persons predisposed to it. Authors speak also of inflammation of the urinary organs among the effects of the epidemic cause.

Epidemic catarrh has usually the same course and duration as the disease from ordinary causes. It generally terminates favourably by perspiration, copious mucous secretion from the bronchia, or increased discharge of urine, which deposits a sediment on standing. Pustular eruptions, erysipelas, and scarlet rashes, are enumerated among the phenomena which occasionally occur at the close of the complaint. The duration of the disease varies from two or three days to one or two weeks; and a cough is frequently left after the other symptoms have disappeared. The fever probably, in most cases, goes off about the fifth day, with copious sweating or expectoration.

A catarrhal epidemic, in which the disease assumed, in frequent instances, a regular intermittent character, with paroxysms occurring daily at a particular hour, and which yielded to the sulphate of quinia, is described by Dr. Samuel Webber, of Charlestown, N. Hampshire. (*Boston Med. and Surg. Journ.*, xxxviii. 149.)

Epidemic catarrh cannot be considered as a dangerous disease. It is scarcely ever fatal, unless complicated with inflammation of the brain, lungs, or heart, or in persons debilitated by old age, or previous maladies, such as chronic catarrh, phthisis, and organic cardiac affections. It occasionally also proves fatal in infants. But, though thus mild in its character, it affects so large a number of individuals, and so many persons in every community are just tottering on the brink of the grave, that it proves the immediate cause of numerous deaths whenever it prevails. Thus, in some places, it is asserted to have proved more fatal in reference to the community at large than even cholera, in consequence of the vastly greater number of persons affected. It has been estimated that, of those attacked by the influenza in its different forms, about two out of every hundred perish.

Causes.—The peculiar nature of this epidemic influence has been a subject of much conjecture and discussion, but has not yet been satisfactorily explained. Some have supposed that it might consist in those atmospheric vicissitudes which have often been observed to accompany the epidemic; but this notion is contradicted by the fact, that the disease has occurred under all possible varieties of appreciable atmospheric condition, at all seasons, in all weathers, and at the same moment in distant places, differing wholly in climate, and the state of the atmosphere at the time. The ascription of the disease to a peculiar electrical state of the air is equally unsatisfactory; for no such state has been shown to exist in connexion with it. That the cause cannot be an exhalation from the earth is proved by its rapid passage from one country to another, from the immense extent of its prevalence, and from the fact, that it acts in the midst of the ocean, which no such exhalation would be apt to reach. The notion of some uncertain telluric influence is too vague to require refutation. Nor does the idea of contagion, though entertained by so high an authority as Cullen, appear to deserve a much more serious notice. It is altogether beyond modern credulity, that a disease which sweeps like a tempest over nations, and prostrates whole communities almost at the same moment, should be propagated by communication from individual to individual. That, though occurring epidemically, it may still have contagious properties, like measles and scarlatina, is another matter, and not so obviously absurd. But there is no good reason even for this modified belief. A contagious disease usually attacks some one individual in a family, and after a certain interval extends to others. The influenza commonly seizes at once upon the whole family. The vicinity of the sick has not been shown in any degree to favour the occurrence of the disease. Contagious affections communicated through the atmosphere usually occur but once. An attack of influenza is no security against subsequent attacks. Contagion lingers long after the epidemic has passed. Influenza leaves few or no straggling cases behind it; unless those of individuals who may suffer relapses from cold or other cause. It is said that the disease has been observed to commence in certain places after the arrival of strangers from infected neighbourhoods, and to spread from the point of arrival. This might happen fifty times, and yet be purely accidental. At present very few believe that the disease is in any degree contagious. The last notion which has been advanced as to the nature of the epidemic cause, is that it is organic, consisting of innumerable animalcules or vegetable microscopic fungi, which have the power of propagating rapidly in the atmosphere, but run a brief course of existence. There is some plausibility in this idea. It explains many of the extraordinary movements of the epidemic, and accounts for the asserted fact of individuals from infected districts becoming the centre of a new prevalence elsewhere. They may bring about their persons, or in their baggage, organic germs, which may soon fill the atmosphere with their progeny. But this hypothesis is wholly destitute of proof; for the assertion that immense swarms of visible insects sometimes appear during the catarrhal epidemic, even if its truth be admitted, goes but a very little way towards proving that the epidemic cause consists in insects that are invisible. It is best then at once to confess our ignorance on this point, and to wait patiently until we can obtain new light.

Treatment.—In relation to the treatment it is necessary to say but little. The disease must be managed in the same way essentially as common catarrh. (See *coryza, laryngitis, and bronchitis.*) There is one prominent difference, however, which requires notice. Almost all writers agree that the influenza does not so well tolerate depletion. Bleeding is not borne well, or if borne, is said to be less effective. In abstracting blood, therefore, it is proper to be cautious, and always carefully to examine the pulse. If this begin to falter, the bleeding should be immediately checked. As a general rule, unless the symptoms of inflammation are decided, it is best to avoid venesection altogether, and to trust chiefly to the diaphoretic plan. Even active purgation is scarcely admissible. Eupatorium, or boneset, has long been recommended in this disease. Dr. Peebles (*Am. Journ. of the Med. Sci.*, N. S., vii. 365) speaks in the highest terms of its utility. He employed it in many cases exclusively, and found it useful by its sudorific, laxative, and emetic properties, when administered early in the complaint, in the form of warm infusion; and by its tonic powers, when given in cold infusion in the advanced stage. When diarrhœa occurs in the latter stages, it may be arrested by means of opium and ipecacuanha. When the debility is considerable, it is often necessary to support the system by tonics, aromatics, and even more powerful stimulants. Should the disease assume a regular periodical character, sulphate of quinia would be indicated.

5. CROUP.

Syn.—Cynanche trachealis.—Angina trachealis.—Tracheitis.—Hives.

This is a disease almost peculiar to infancy and childhood. The name of *croup*, by which it is usually designated, is of Scottish origin, and is said to be derived from *roup*, a word used in some parts of Scotland for the sound made by a chicken with the pip. No correct scientific name has yet been adopted, embracing all the varieties of the disease. Cullen's *cynanche trachealis*, and the more modern *tracheitis* are objectionable designations; as they lead to false notions of the pathology of the affection. Croup is not essentially inflammation of the trachea. It may exist without disease of that portion of the respiratory passages; and inflammation of the trachea often takes place in infants, as in their catarrhal affections, without producing the symptoms of croup. The complaint may be confined to the larynx; though it generally embraces also the trachea, and not unfrequently extends deeply into the bronchial tubes. It may, therefore, occupy one or several divisions of the respiratory passages. If any one part is necessarily affected, it is the larynx; for a case would scarcely come under the designation of croup, in which this organ should not be disordered, at least in its functions.

To constitute croup two circumstances are essential. One of these is inflammation or high vascular irritation of the laryngeal, or laryngo-tracheal mucous membrane. But that inflammation alone does not constitute the disease is proved by the fact, that it often exists without the peculiar croupal phenomena, as in measles, catarrh, smallpox, &c. The additional circumstance, not less essential than inflammation, is spasm of the interior muscles of the larynx. It is this which distinguishes the croup of children from the similar inflammatory affections of adults, occupying precisely the same structure. Some have supposed that a variety of croup exists which is purely spasmodic. It is certain that the muscles of the glottis sometimes contract spasmodically, without inflammation or vascular excitement; but the phenomena are different from those of croup, and belong to a different pathological condition.

Definition.—Croup, therefore, may be defined to be a disease, in which inflammation or high vascular irritation of the laryngeal, or laryngo-tracheal mucous membrane, is combined with spasm of the interior muscles of the larynx, giving rise to peculiar modifications of voice, cough, and respiration.

Varieties.—Under the name of croup are usually confounded two forms of disease, materially different in their character, and greatly so in their results. This will scarcely admit of contradiction, when we consider that, of the cases commonly called croup, both popularly and professionally, in this country, a vast majority are very manageable, yielding with great facility and with considerable certainty to the early application of remedies; while the disease, as described by most European writers, is stated, under precisely the same treatment, to be exceedingly fatal, even when attacked in the early stage, and almost necessarily so in the advanced stage. Without having the support of statistics, I do not think I shall greatly err in stating, that not one in fifty patients dies of ordinary croup in this country, when properly treated; while European writers inform us, that formerly the proportion of deaths was four out of five, and at present, when the treatment is better understood, is not less than one half. The two forms of the disease differ essentially in the product of the inflammatory action. In the more curable variety, the mucous membrane, if it secrete at all, yields mucus, pus, or a muco-purulent fluid, according to the degree and stage of the inflammation. In the more dangerous form of the disease, an albuminous or fibrinous exudation takes place upon the inner surface of the air-passages, giving rise to the formation of false membrane. In the former, the inflammation is exactly analogous to that which takes place in catarrh, and, as in that affection, may be of every grade, from the slightest and most trivial, to the severest and most dangerous. The disease differs from catarrh only in consequence of the addition of spasmodic symptoms. In the other form of croup there is something peculiar, either in the character of the diseased action, or the state of the blood, which induces the peculiar effusion. The nature of the exudation, in this case, has nothing to do with the violence of the inflammation; for the false membrane is often produced when the inflammatory action is only moderate, as proved both by the phenomena during life, and the results of dissection. The milder form of the disease will be distinguished in this treatise by the name of *catarrhal croup*, the more dangerous, by that of *pseudo-membranous croup*.

But, while making this distinction in the general character of the two varieties, I admit that the catarrhal form may run into the pseudo-membranous; in other words, that a case beginning with the symptoms of the former may terminate with those of the latter. Indeed, in the earliest stage, before secretion has commenced, it would be impossible to determine, with certainty, which form the disease was about to assume. Again, there may be cases in which the two forms shall be combined; that is, in which one portion of the membrane shall secrete mucus, and another exude fibrin; and the relative amount of the secretion and exudation would determine the position of the case in one or the other division. From these facts the important practical inference is deducible, that, in every case in which the symptoms of croup appear, efficient remedies should be promptly applied; for, if carefully employed and properly guarded, they can do little serious injury; while the neglect of them may possibly lead to the most deplorable consequences. No rule in medicine is more certain, than that every case of croup, whatever may be its apparent character, should be treated promptly and efficiently.

1. **Catarrhal Croup.**—*False croup.—Stridulous laryngitis.—Stridulous angina.—Spasmodic laryngitis.*—This is sometimes called *spasmodic croup;* but the name is improper, as both forms of the complaint are more or less spasmodic. In giving it the name of catarrhal croup, I wish to be understood merely as indicating that the inflammation is of the same general nature as that which occurs in catarrh.

Symptoms, Course, &c.—The disease commences variously. Not unfrequently the child is affected for some time with the symptoms of common catarrh, such as coryza, sore-throat, bronchial irritation, cough of an ordinary character, and perhaps fever, before those peculiar to croup are developed. Very often a croupy cough and some hoarseness precede the attack for some hours or even days; and this state of things, though always suspicious, sometimes passes away spontaneously, without the occurrence of the fully formed disease. Either after the prevalence, for a shorter or longer time, of the symptoms just referred to, or altogether without premonition of any kind, the child is attacked with a paroxysm of coughing and dyspnœa, having certain peculiar and highly characteristic features. In the majority of instances, this occurs in the night, and more frequently in the early part of it than towards morning. The paroxysm differs greatly in severity in different cases, being sometimes very slight, sometimes violent and alarming, and of every intervening grade between these two extremes. The following description applies to one of a very decided character.

The child usually starts out of sleep with a peculiar dry, sonorous, ringing cough, sounding, according to Cheyne, as though it came through a brazen trumpet; but in fact comparable to nothing else in nature, and to be appreciated only by being heard. When once heard, it will always afterwards be easily recognized. So characteristic is it of this disease, that, when met with in other affections, as sometimes happens, it is called the *croupy* cough. It is occasioned, in all probability, by a certain spasmodic rigidity of the vocal cords, giving an almost metallic tension to the sides of the rima glottidis. Immediately succeeding the cough there is often a shrill, stridulous sound, produced during inspiration; and the two sounds together, that of the cough and of the inspiration, have been compared to the barking of a small dog, or the crowing of a young cock, though the resemblance is not very obvious. Along with the cough, which is frequently repeated, the child is affected with dyspnœa, which is often severe and very distressing; the respiration being dry, wheezing, and often sonorous, as if the air entered through a narrowed passage, with firm vibrating walls. If the child attempt to speak, the voice is usually more or less rough and hoarse, though very rarely quite extinct or whispering, and scarcely ever more than temporarily so. This is an important point in the diagnosis of the two varieties of croup. So long as the voice is sonorous, even though occasionally suppressed during a paroxysm of laryngeal spasm, there is good reason to hope that the case may not prove to be pseudo-membranous. The distress of the little sufferer during the paroxysm is often very great. He sits up or tosses himself about in bed, supports himself on his hands and knees, or lies on his back with his head extended, so as to give as great a permeability as possible to the trachea; puts his hands to his throat as if to remove some difficulty there, or holds them out imploringly for aid from his attendants; and, as if conscious of threatened suffocation, has upon his countenance an alarmed, anxious, and affectingly beseeching expression. Sometimes, when able to speak, he complains of tightness or pain in his throat; but his voice, and his piteous attempts to cry, are often stifled by the cough, and increase the violence of the paroxysm. At first the countenance is usually flushed, the skin warm, and the pulse frequent and febrile; but, unless the paroxysm subside, especially when it is very severe, the effects of the impeded respiration begin to be experienced in the state of the blood, which is insufficiently aërated. The lips assume a purplish or livid hue; the face becomes pale, the extremities cool, the pulse very frequent, feeble, and irregular; and a condition takes place approaching to asphyxia, during which the spasm relaxes, and the air is allowed again to enter the lungs more freely. The violent symptoms are now moderated, and the paroxysm gradually subsides, so that the child falls to sleep, and upon awaking is found to have been greatly relieved. In some extraordinary cases, complete and fatal asphyxia may take place before the spontaneous subsidence of the paroxysm; but this is exceedingly rare, and never, perhaps, under suitable treatment.

Very generally the symptoms are much more moderate than as above described. They are said to be less severe when the attack occurs in the daytime. The duration of the paroxysm varies from a few minutes to several hours. In the morning the patient often appears nearly well, except that an occasional cough may be heard, the croupy sound of which gives warning that the disease is not yet gone. There may also be some hoarseness of the voice, and, if the fauces are examined, they may be found somewhat reddened. Should proper treatment be adopted, there may be no return of the paroxysm of dyspnœa; and the child may be restored to health. This result sometimes takes place even without treatment. But in general the cough and dyspnœa return, occasionally during the day, but more frequently in the following night, and often with symptoms more violent than at first. A similar course is run, though perhaps with a less complete subsidence of the symptoms; and for two, three, or four days, the disease continues, with occasional exacerbations and remissions, and with a more or less threatening aspect, according to the degree of the accompanying inflammation. If this is moderate, it gradually yields, and along with it the spasmodic paroxysms, which become milder and milder, and at length cease to recur; the child being left with nothing but a catarrhal cough, which is of little consequence and soon disappears.

But often, especially when not properly cared for in the beginning, the course of the disease is less favourable. Sometimes the symptoms of pseudo-membranous croup supervene, indicated by a huskiness of the voice, gradually increasing until no sound can be uttered above a whisper. But this is rare; and the greater violence of the disease depends simply on the greater severity or extent of ordinary inflammation of the air-passages. This frequently affects the bronchia; and then, along with the peculiar phenomena of croup, are those of catarrhal fever, such as a hot skin, an accelerated pulse, rapid respiration, frequent cough, and often pain or soreness of the chest, indicated by the crying of the infant after every paroxysm of coughing. When the laryngeal or tracheal inflammation is severe, there are pain and soreness upon pressure, with occasional swelling of the external parts, and constant difficulty of breathing, with sonorous or even sibilant inspiration, dependent partly upon swelling of the mucous membrane, and partly upon spasm of the muscular fibres. But the voice, though hoarse, is not suppressed; and the cough is sonorous. In connexion with these symptoms, which are constant, the paroxysms of dyspnœa return with greater frequency and violence than in milder cases. The slightest cause, such as crying, attempts at speaking, drinking, mental emotion, &c., brings on the most distressing difficulty of breathing, with a suffocative cough, occasionally attended with vomiting, probably in consequence of the irritating movements of the fauces. If not relieved, the patient may go off suddenly in one of these spasmodic exacerbations; or, after suffering inexpressible agony, may perish of a slower suffocation, with a cold skin, clammy sweats, a feeble vanishing pulse, and ultimate coma.

If he survive, a new train of symptoms commences, which may be considered as the second stage of the disease, and usually makes its appearance at the end of two or three days. It is the stage of secretion. The cough now sounds loose and more broken, especially towards the end of a paroxysm; and a portion of mucus is often thrown up, clear or tinged with blood. Should the attack be disposed to terminate favourably, the paroxysms of coughing become shorter and less severe, the inspiratory sounds acquire a mucous character, the cough loses its harsh ringing tone and becomes quite loose, and, if the child be old enough to expectorate, mucus is discharged freely, at first clear, then whitish and opaque, and ultimately purulent, exactly as in catarrh. The fever subsides, the croupy symptoms quite disappear, and the child recovers completely, in a length of time varying from three or four days to two weeks from the commencement. Sometimes, however, an excess of secretion beyond the ability of the patient, already greatly weakened, to throw off from the lungs, added to the embarrassment of the respiration from the laryngeal and tracheal disease, brings on a fatal defect of hæmatosis. Not unfrequently, too, the bronchial symptoms become mingled with those of pneumonia, which adds greatly to the danger. Indeed, though the child occasionally perishes in a spasmodic paroxysm, death is generally occasioned, in this disease, by supervening or accompanying bronchitis or pneumonia. Throughout the complaint, the stomach is usually remarkably insensible to emetic impressions, and the bowels are rather torpid than otherwise. After recovery, relapses are remarkably frequent.

The *physical signs* are not very distinct. The stridulous respiration, according to Williams, may be detected by the stethoscope or ear applied directly to the throat, before it becomes sensible in the ordinary manner. The sounds of the chest are obscured by the louder sounds of the larynx; but, if the patient be examined after the subsidence of a paroxysm, or during the relaxation which follows the operation of an emetic, the peculiar signs of bronchitis or pneumonia may generally be detected, if existing in a marked degree.

Dissection exhibits redness of the mucous membrane of the larynx, trachea, and bronchia, either in patches or continuous, with occasional swelling of the submucous tissue from inflammatory infiltration, and more or less mucus in the air-passages, which, if death has taken place early, is scanty, viscid, and adherent to the sides of the tubes, if in the more advanced stages, is more abundant and often purulent. Occasionally patches of adhering false membrane may be detected, but insufficient to have had any agency in the fatal result. In some rare instances, no signs of disease are discovered in the mucous membrance, and the patient has probably died of spasm, consequent upon high vascular irritation or congestion, the marks of which disappear with life.

The *prognosis* in this variety of croup is almost always favourable, if treatment has been commenced early, and no complications exist. In the vast majority of cases, the disease may be quickly arrested by proper curative measures in the first stages. Indeed, it is often treated successfully in domestic practice; and very numerous cases occur to which the physician is never called. But, if the patient is neglected until the inflammation has penetrated into the ultimate ramifications of the bronchia, or into the pulmonary tissue, or if the disease assume the pseudo-membranous form, the issue is much more uncertain, and not unfrequently fatal.

2. **Pseudo-membranous Croup.**—*Pseudo-membranous pharyngo-laryngitis*, or *true croup.* (Guersent.)—*Pseudo-membranous laryngitis.* (Rilliet and Barthez.)—*Laryngeal diphtheritis.*—This variety of croup is, compared with the former, in this country at least, a very rare disease. It is, however, the form usually described by European writers under the name of croup; and it is important to bear this fact in mind in estimating the value of their statements. That such is really the case, will be inferred from the exceedingly fatal character which they assign to the disease. That, by some of the best English authors, the two affections have been more or less confounded in description is true; but they must have had their eye fixed on the more dangerous variety, if we are to judge from their prognosis alone. Possibly, the disease may present a somewhat different aspect in Great Britain from that which it offers with us, and may in all cases have a tendency to the more dangerous form. Some recent French and German writers recognize the distinction clearly, and treat of our common disease under a distinct designation. Guersent calls it *false croup.*

Symptoms, Course, &c.—This affection begins variously. In some instances, it has the pseudo-membranous form from the very commencement; the occurrence of the inflammation and of the exudation being, so far as can be observed, quite simultaneous. This is not owing to any peculiar violence in the inflammatory act; for the grade of inflammation in these cases is, in fact, often feeble, and sometimes, in the beginning, scarcely sufficient to induce fever. It is, as before observed, to the peculiar character of the inflammation, or of the blood, that the result is to be ascribed. I once attended the case of a little girl, who, when first visited, was running about the apartment with no other apparent disease than a whispering voice, and perhaps some little difficulty of respiration; yet she was, at that moment, almost as surely condemned to death as though she had been in the last stage of the disease; for the membrane was already formed, and no efforts could prevent its fatal progress. The disease may be suspected, in such cases, when the voice cannot be raised above a whisper, when the cough is as it were muffled, when some wheezing in inspiration can be detected, and especially when an examination of the fauces reveals patches, or a continuous coating of fibrinous exudation on the soft palate, half arches, or pharynx.

But very frequently inflammation exists, and makes itself evident, before any considerable amount of plastic exudation has taken place. Indeed, the symptoms are sometimes at first exactly those of the catarrhal croup, and the difference is not detected until the voice begins to become whispering, and the cough to exchange its peculiar ringing or sonorous character for a husky sound. It may be said that, in these cases, the disease is the same, with the single exception, that a plastic instead of diffluent exudation takes place. But it is this peculiar plasticity of the secretion that constitutes the very essence of the affection; and the vast importance of the consequences certainly justifies us in ascribing to it the rank of at least a distinct variety of the disease. The occurrence of the changes above mentioned in the voice and the cough, though not certain signs, should always lead to the suspicion that false membrane is forming.

Often, instead of being either fully formed at the outset, or of beginning like ordinary catarrhal croup, the complaint has an intermediate character. There is more or less cough, which is rough and hoarse, or hollow and of a grave tone, but not peculiarly sonorous. It may even differ in no respect from a common cough, when the disease does not happen to begin in the larynx. The voice, too, is hoarse; as in a common cold in an adult. But the symptoms soon become more characteristic. The voice gradually sinks into a whisper, above which it can scarcely be elevated by any efforts of the patient. The cough altogether loses whatever sonorousness it may have possessed, and becomes husky, and as it were stifled in the throat. Each effort of coughing is often followed by a short whistling, or sibilant sound in inspiration. The cough sometimes occurs in spells or paroxysms, and, though often frequent, is sometimes rare and at distant intervals. At length the breathing becomes difficult; every inspiration has more or less of the sibilant character, or sounds as if the air were forced through a narrowed and rigid passage. The voice is now whispering or quite extinct, and the effort to speak often excites paroxysms of a muffled cough, attended with pain in the throat and upper part of the chest, with great dyspnœa, swollen and darkened features, anxiety, restlessness, jactitation, and feelings as of impending suffocation. These symptoms, though never absent, relax for a time, to return with equal or increased violence from the slightest cause, and often without apparent cause. The child is afraid to speak lest he may thereby induce a paroxysm. Sooner or later, there is always some febrile action, and, when the inflammation is severe or extensive, it is very high. In all cases, the pulse is frequent, and towards the close excessively so. The respiration is also quickened, sometimes to between forty and fifty in a minute. In the intervals of the paroxysms, the patient is disposed to sleep. Cases now and then occur, in which the spasmodic character is nearly wanting, and the disease marches directly onward to suffocation, almost without paroxysms.

Should the case now take a favourable turn, the cough, instead of being perfectly dry and tight, sounds loose or broken, as if from the presence of liquid in the bronchia. Sometimes it produces on the ear an impression as if there were a concrete substance with one end loose, moving backward and forward with the motion of the air. If the child is old enough to expectorate, some viscid mucus is coughed up, either transparent or opaque, and occasionally mixed with flakes or patches, or even tubes of concrete fibrinous

matter. It is not always, however, that this membranous sub
up, even when it exists in the tubes. It is probably sometim
the mucus or muco-purulent matter, and sometimes gradual
we see the similar matter disappear, which is now and then th
the surface of the fauces. This sort of expectoration is said
scarcely one-third of the cases. (*Rilliet* and *Barthez.*) It occ especially after the action of powerful emetics. Sometimes the discharge of the false membrane gives great relief; and the patient goes on recovering with a gradual, or even sudden amelioration of all the symptoms, though suppression of the voice, more or less complete, for a considerable time after recovery, is not uncommon. In other cases, however, after a partial amendment, the symptoms return with all their former violence; the false membrane is renewed, or penetrates more deeply into the respiratory passages, and the little sufferer passes into the last and fatal stage of the disease. I have seen a relapse of this kind, after the discharge of a tube about two inches long.

The symptoms of the last stage occasionally come on very early, even within twenty-four hours from the commencement of the attack. More frequently, however, they are postponed for three or four days, and sometimes considerably longer. This stage is characterized by the excessive difficulty of respiration. Along with complete suppression of the voice, and a perfectly tight and dry, though now comparatively infrequent cough, the inspiration is wheezing and sonorous, so that it may be heard at a considerable distance. The child uses his utmost efforts to expand the chest, and the respiratory muscles are thrown into almost convulsive action. The shoulders rise, the breast heaves, the nostrils expand and contract, the head is thrown backward, and the intercostal spaces may be observed to be pressed inward by the weight of the air, which finds the ordinary entrance almost closed against it. The force of the respiratory effort is sometimes so great as to rupture the air-cells of the lungs, and even to make a rent between the rings of the windpipe. The child appears in an agony of distress. He throws himself about in bed, or jumps up and runs to the window for air, his face bearing, meanwhile, a most anxious, alarmed, and imploring expression. At length the powers of the system fail. The pulse becomes exceedingly quick and feeble, the skin cool and bathed in sweat, the cheeks pale and cold, the lips livid; and the former agitation at first alternates with, and then gives way to drowsiness or stupor. The brain and heart, no longer stimulated by arterial blood, cease to act, and the patient sinks gradually and quietly away; or the nervous system rouses itself for a last struggle, and death takes place in the midst of convulsions. Not unfrequently, however, the patient is cut off, at an earlier stage, by suffocation in one of the paroxysms of dyspnœa. Instances of recovery from the last stage are very rare. The duration of the disease varies from less than a day to one or two weeks.

The symptoms vary at the outset with the portion of the air-passages first affected. When the larynx and trachea are first seized upon, the phenomena of the disease are as above described. But sometimes it begins in the bronchia, and travels upward; so that the symptoms of bronchitis precede those peculiar to the croup. In other instances, the starting point appears to be in the fauces, or posterior nares, as we frequently see in ordinary catarrh. In such cases, there is sore-throat and some pain in swallowing, for a longer or shorter time antecedent to the laryngeal symptoms; and, if the fauces be inspected, a white or yellowish membranous exudation may be seen, diffused or in patches, upon the soft palate, half arches, and pharynx. Sometimes the whole fauces are thus covered. The first sign of the disease having reached the larynx is usually hoarseness of the voice and cough; and, after the occurrence of these, the developement proceeds as above described. Bretonneau and Guersent believe that the disease begins in this way in the great majority of cases. It may be so in France; but is not so in this country, so far as my observation has extended; and does not appear to be so in Great Britain, from the accounts of British writers. We have occasionally severe cases of croup, occurring during epidemics of scarlet fever; and now and then cases of diphtheritic sore-throat, such as have commonly been called ulcerated or malignant sore-throat, which probably depend upon the same cause as scarlet fever, frequently at least, and like that, end in pseudo-membranous croup. But these affections differ from ordinary croup, whether catarrhal or pseudo-membranous, both in their origin and in some of their symptoms. They are generally attended with a low, typhoid, or adynamic state of system, not unfrequently with a fetid breath, and sometimes with strongly malignant symptoms. Their cause is usually either epidemic influence or contagion, neither of which produces ordinary croup, unless perhaps when it attends influenza. In fact, their only resemblance to this affection is the presence of a pseudo-membranous exudation in the larynx. They come under the head of what some European writers call *secondary croup*, though, as appears to me, not very appropriately; for ordinary pseudo-membranous croup often follows an attack of catarrh, and might, under such circumstances, with equal propriety be called secondary. After all that has been said, however, there is no doubt that ordinary croup of this variety occasionally begins by pseudo-membranous inflammation in the fauces; but such cases are the exceptions, and not the rule.

Diagnosis.—The loss of voice and the extinction of the sound in coughing, the appearance of albuminous or fibrinous exudation in the fauces, and the expectoration of patches or tubes of false membrane, are diagnostic symptoms of this variety of croup. The only certain one, however, is the last. The suppression of the voice is sometimes met with in catarrhal croup, and false membrane in the fauces is often absent in the disease, at least as it occurs in this country; nevertheless, when the former symptom occurs at a somewhat early stage, and afterwards perseveres, with a steady march of the disease towards a state of extreme danger, there is little reason to doubt its pseudo-membranous character. Barth and Roger state that a trembling vibratory sound may often be heard in auscultation, during the ingress and egress of the air through the larynx and trachea, denoting the presence of floating false membrane. (*Traité Pratique d'Auscultation.*) This sign may be of some value in the diagnosis.

It has been stated as essential to the constitution of croup, that the larynx should be more or less involved. Pseudo-membranous inflammation sometimes attacks the trachea, without in any degree involving the larynx. This is tracheitis, but not croup. There are fever, cough, pain, and soreness in the trachea, and gradually increasing difficulty of respiration; but, although the patient may speak low from pain, there is no extinction of the voice, nor croupy sound of the cough, nor whistling sound of inspiration such as follows the cough in genuine croup. The patient may expectorate a portion of false membrane and recover, or the disease may descend deeply into the bronchia, and bring on fatal suffocation. Sometimes the disease attacks the bronchia exclusively. The symptoms are then those of severe bronchitis, with more of stricture and suffocative sensation than in ordinary cases, and with the occasional discharge of pseudo-membranous matter after violent fits of coughing.

Anatomical Characters.—False membrane is always found somewhere upon the free surface of the mucous membrane of the air-passages. * According to Guersent, it is never entirely absent in the larynx. It is sometimes confined to the glottis, sometimes lines the whole interior of the larynx, including the ventricles, and not unfrequently extends throughout the trachea, and for a greater or less distance into the bronchial tubes. I have seen a case in which it lined the upper portion of the bronchia, the whole trachea and larynx, and the pharynx as low down as the œsophagus. It occasionally reaches even the remote ramifications of the bronchial tubes. Sometimes the deposit forms perfect tubes, which, when removed, bear no inconsiderable resemblance, as suggested by Dr. Cheyne, to macaroni boiled in milk. More frequently, however, it is in patches, or long narrow ribbons, and occasionally, especially in the earlier stages, has a granular aspect, with the red mucous membrane appearing in the intervals of the imperfectly connected grains. In some instances, it adheres firmly, especially in the upper part of the tube; but it is frequently loosened by intervening mucus or muco-purulent secretion, in which the lower extremity sometimes floats loosely.

The false membrane is sometimes thin and delicate, more frequently thick, opaque, white or yellowish-white, and smooth on both surfaces. It varies much in consistence, being in general tough and almost leathery, in some instances soft, and in some nearly diffluent towards the lower extremity. In the larynx, it is said to be less firm than in the trachea. In chemical nature, it is closely analogous to the fibrin of the blood, and to the exudation which takes place upon inflamed serous surfaces. It is dissolved by alkaline solutions and strong acetic acid. The question is not yet settled, whether this matter is susceptible of organization. Generally, the false membrane shows no sign of such a condition. It is said to have been found partially organized in some rare cases; and certain red points and lines upon its adhering surface, which cannot be washed off, have been thought, though probably on insufficient grounds, to be the commencement of vascularity.

In the cases associated with other diseases, as smallpox, scarlet fever, &c.; the false membrane is usually yellowish, less firm than in the original cases, less adherent, and often associated with considerable mucus or pus. It seldom extends, unless in small quantity, below the larynx.

When the deposit is removed, the mucous membrane beneath it, though sometimes quite healthy in appearance, and seldom exhibiting the marks of severe inflammation, is commonly reddened either partially or generally; and the red points and streaks correspond with those upon the separated surface of the false membrane. Sometimes, though rarely, the mucous membrane is softened, and still more rarely thickened. The bronchial tubes are usually more or less extensively reddened, and contain an opaque, whitish, greenish, or yellowish puriform mucus, sometimes in large quantities. Signs of lobular pneumonia, and an emphysematous condition of the pulmonary air-cells, are not unfrequent.

Causes of Croup.—The most common cause of this disease in all its forms, certainly in its ordinary catarrhal form, is cold, or cold combined with dampness. The disease is said to prevail most in moist places. It is frequently brought on by the sudden passage from hot to cold air, and in infants is probably often occasioned by sleeping in very cold chambers, after having been all day in hot rooms. Irritating substances inhaled into the lungs have sometimes caused it. Foreign bodies lodged in the larynx give rise occasionally to closely analogous symptoms.

Among the predisposing causes, age appears to have the greatest influence. The disease is not positively confined to any period of life; but it is exceedingly rare in adults, and is seldom seen in very early infancy. From one to seven years is the age at which it is most prevalent; though cases are not very uncommon at any period before puberty. The catarrhal variety usually occurs at an earlier age than the pseudo-membranous; and the cases in infants less than a year old are generally of the former kind. The pseudo-membranous cases which have come under my observation have almost always been between the second and sixth year. It is probable that the change of diet, after weaning, may contribute to render the blood more favourable to the plastic exudation. The structure of the larynx in children probably disposes to the spasmodic phenomena; but we are to look for the main cause of these rather in the more excitable condition of the nervous system generally at that age, than in any local cause. When persons in advanced life are attacked with croup, it is generally of that variety which attends the diphtheritic disease of the fauces, and is produced by epidemic influence.

Sex appears to have some causative influence, at least as relates to pseudo-membranous croup; for this has been observed to be much more common in males than females. The disease sometimes appears to run in families. All the children of certain parents are peculiarly predisposed to it, while those of others escape. Vigorous and fleshy children, with rosy complexions, are said to be most frequently affected.

The disease has also been ascribed by some writers to epidemic and contagious influence. But, if we except the cases which are apt to occur during the prevalence of epidemic catarrh, it is only to the diphtheritic disease of Bretonneau that this remark is applicable. Original, uncomplicated croup is probably never either epidemic or contagious.

Certain febrile diseases strongly predispose to one or the other form of croup. The influenza and measles are often attended with the catarrhal variety; scarlatina and smallpox with the pseudo-membranous.

Treatment of Catarrhal Croup.—The treatment in this disease should always be prompt and decided. It is impossible, from the first symptoms of croup, to determine, in any case, that it will be harmless. Should it be mild in its tendencies, it will probably yield at once to the moderate measures which are first employed in all cases, and no injury can result. Should a disposition to pseudo-membranous effusion exist, a prompt interference affords, in many instances, the only chance of safety.

So soon as croupy cough and dyspnœa occur, an emetic should be administered without hesitation. In this disease it is often difficult to vomit, and larger doses are usually required than under ordinary circumstances. The choice of the emetic should depend on the degree of violence in the symptoms. When these are mild, with little or no fever, ipecacuanha should be given; when they are severe or decidedly febrile, tartar emetic is preferable. One of these will generally answer the purpose. To a child two years old, from four to six grains of ipecacuanha, or from one-quarter to one-third of a grain of tartar emetic, may be given diffused or dissolved in water, every fifteen, twenty, or thirty minutes, until vomiting is produced. Tartar emetic is the more efficient of the two, because more nauseating and consequently relaxing, more sedative, and more powerfully revulsive. It should always be preferred in doubtful cases, or at least should be combined with the ipecacuanha. Should the emetic not be at hand in substance, one of its officinal preparations may be resorted to; as the wine or syrup of ipecacuanha, in the dose of a fluidrachm of the former and two fluidrachms of the latter, or antimonial wine in the dose of a fluidrachm. I have seldom had occasion to employ any other emetic than these in the early stages. Others, however, are occasionally used. Dr. Archer, of Maryland, recommended seneka, urged to the point of emesis. There is no doubt that this medicine exercises a powerful alterative influence over the respiratory mucous membrane, and is, therefore, capable of doing good independently of its merely emetic property; but, in reference to this alterative power, I have always considered it more applicable to the advanced than to the earliest stages. Nevertheless, this remedy combined with squill and tartar emetic, in the form of the officinal *compound syrup of squill*, more commonly named, after its original inventor, *Coxe's hive syrup*, is much and advantageously employed, both in regular and domestic practice, in all stages of croup. Thirty or forty minims may be given to a child two years old, and repeated at short intervals till it vomits. Dr. Hubbard, of Hallowell, in Maine, strongly recommends turpeth mineral, which, while scarcely less efficient than the antimonial, he considers safer, as less prostrating, and less disposed to act on the bowels. He gives two or three grains to a child of two years, and repeats the dose every fifteen minutes till it operates. (*Trans. of Phil. Col. of Phys.*, A. D. 1845, p. 332.)

Should the emetic not be disposed to act, it will be much aided by a warm bath, in which the whole body should be immersed, the water being warm enough to relax, but not so hot as to stimulate. About 98° or 100° will be a suitable temperature. The immersion should continue fifteen or twenty minutes, or even half an hour if necessary. Great care must be taken that the skin of the child be not exposed to cold air during the process. When removed from the bath, he should be wrapped for a time in a warm blanket, and wiped dry with a heated towel. Even after emesis, if the symptoms should not have given way, the bath may be resorted to; and in all stages of the disease, except the last, it constitutes one of the legitimate means for overcoming spasm in the paroxysms.

After vomiting, the child is often greatly relieved. The spasm relaxes, the breathing becomes easy and quiet, the voice loses much of its hoarseness, and the patient falls into a gentle sleep, from which he awakes much improved, if not well. In mild cases, the cure is now frequently accomplished. From my own observation, I should say that the great majority of cases will yield to this simple treatment; nothing more being subsequently necessary than to open the bowels, if not already loose, by a dose of castor oil, and to sustain a slightly nauseating or expectorant effect by small doses of antimonial or ipecacuanha wine, or the compound syrup of squill, given at intervals of two, three, or four hours, and continued till the croupy cough ceases, and the danger of another paroxysm is passed. But a caution is necessary, to inexperienced practitioners, in relation to the use of tartar emetic under these circumstances. If too largely given, or too long continued, it may produce great and even fatal prostration. I have witnessed a case of death in an infant, resulting from repeated doses of antimonial wine, directed by a practitioner after a paroxysm of croup, without any reference to the time or circumstances of its omission. The parents continued to repeat the dose until the child was prostrated beyond recovery. The stools were in this instance white, as in malignant cholera. Directions should always be left to omit the antimonial if it purge, or otherwise prostrate much, and whether or not, provided the croupy symptoms quite disappear.

But, in many instances, the spasmodic symptoms resist the action of an emetic, or return after a shorter or longer interval of comparative relief. This is very apt to be the case when there is considerable inflammation. In such instances, if the pulse is full and vigorous, it is proper to bleed from the arm. The quantity of blood taken should be regulated by the effects produced. It is desirable that the pulse should be reduced, but not to the point of syncope. From two to five ounces may be taken from a child two years old, and somewhat less than an ounce be added for each year. Dr. Cheyne recommends bleeding from the jugular vein, in very young children. Should the bleeding not afford the requisite relief, the emetic with or without the warm bath may be again resorted to. Should this fail, an efficient remedy remains in tobacco, which may be applied, in the form of fomentation or cataplasm made from the leaves, upon the front of the throat. I have seen this of great use in severe cases of laryngeal spasm. But it is necessary to be cautious, especially in children, and to remove it as soon as its relaxing effects have been obtained. Dangerous prostration may result from a neglect of this precaution. The remedy is one which should never be employed in domestic practice, and should generally be applied under the immediate superintendence of the physician. It should never be placed upon a blistered surface. The internal use of lobelia is here also highly serviceable; and, when a powerfully relaxing effect is required, it may be combined, in powder or tincture, with one of the emetics already mentioned.

The above treatment is adapted to the paroxysm. It scarcely ever happens that this does not give way, however violent, if the case be not pseudo-membranous, to some one of the remedies mentioned, or some combination of them. After the spasmodic paroxysm has been subdued, or has subsided, the treatment must be guided altogether by circumstances. If the croupy phenomena have disappeared, and only a cough with moderate catarrhal symptoms remains, the treatment before mentioned as proper after the subsidence of the paroxysm may be adopted. But it often happens that, though the violent spasmodic symptoms give way, there are yet considerable inflammation and fever, with some cough and dyspnœa, threatening a return of the paroxysms. Under these circumstances, it will be proper to administer a full purgative dose of calomel, which should be followed in a few hours by castor oil. Three or four grains of the mercurial may be given to a child two years old. Few remedies are more efficient in the relief of infantile catarrh than this. The patient may at the same time be kept moderately under the influence of antimony, ipecacuanha, or seneka, or combinations of them; and advantage will occasionally accrue from warm poultices to the feet, made of bruised garlic, mixed with the bread and milk or flaxseed meal cataplasm.

If, in connexion with the cough and febrile symptoms, there should be considerable difficulty of respiration, a hoarse or sibilant sound during inspiration, or evidences of pain in the throat or chest, leeches are an admirable remedy. It is always best to make use of our native leeches, as there is with them less subsequent bleeding, and we are better able to regulate the quantity of blood lost. Dangerous and even fatal prostration has sometimes resulted from the difficulty of arresting the hemorrhage, consequent upon the bite of the European leech, in very young children. The leeches should be applied upon the throat, or upper part of the chest, according to the apparent seat of the severest inflammation. Great care should be taken, during their application, that the skin of the child be not chilled by wet and exposure. In young infants, leeches may be employed as a substitute for the lancet. In a child of two years, from twelve to twenty-four leeches may be applied, so as to take from two to four ounces of blood. After leeching, an emollient cataplasm should be applied to the chest or throat, or to both. This is often highly useful in inflammation of the air-passages.

Should paroxysms recur with the original or increased violence, it will be necessary to go through the same routine of remedies as at first; viz., an emetic, the warm-bath, bleeding once more if the pulse will permit, and the tobacco cataplasm; recourse being had to the latter remedies only when the former fail. Bleeding in this stage must be used with more caution than at first. It is scarcely probable that the bronchial inflammation can be resolved without a great increase of secretion; and there may be danger that the strength may be reduced so far as to disable the child from coughing up the mucus, which would thus overwhelm the lungs, and produce suffocation.

After the subsidence of the more violent inflammatory symptoms, counter-irritation to the throat and chest, by means of blisters or active rubefacients, will often be useful in removing the remains of the inflammation, and the tendency to a recurrence of the spasm. Rubefaction may be produced by mixtures of the oil of turpentine or solution of ammonia, or both, with olive oil, spirit of rosemary, camphor, &c., or by means of a cataplasm containing a proportion of mustard or garlic. If flies are used for blistering, they should not be allowed to remain in contact with the skin longer than three or four hours, and should then be followed by a poultice. If a powerful and very speedy impression is desired, it may be made with the strong solution of ammonia, which, however, should be used with great caution.

If the physician should not be called until the disease has entered into its advanced stage, and the peculiar symptoms should then be more or less continuous, such as dyspnœa, the croupy cough and voice, high fever, and signs of considerable or extensive inflammation in the respiratory passages, he should at once take blood as freely as the pulse and general strength may allow, and, if doubtful about bleeding, should substitute leeching, with the same caution. Emetics, the warm bath, calomel as a purge, and the steady use of antimonials in moderate doses, repeated at short intervals, should follow successively; and, in case of severe spasm, tobacco externally, and lobelia with decoction or syrup of seneka internally, may be superadded.

After the employment of the above remedies unsuccessfully, an attempt should be made without hesitation to bring the system under the influence of mercury, and, for this purpose, one grain of calomel may be given every two hours, united, if it purge, with a little Dover's powder; and mercurial frictions may also be made to the inside of the upper and lower extremities.

It very seldom happens that a patient with catarrhal croup may not be rescued by some of the above remedies, if timely applied. But it may happen that no medical aid is obtained until the disease is already in its last stage; or the means may have been inefficiently employed; or finally, in some few instances, the tenacity of the complaint may have been such as to resist the best directed measures. The system is now too much enfeebled by the carbonaceous state of the blood, and the exhausting influence of the disease, to admit of depletion. The lungs are overwhelmed with the mucous or purulent secretion, which the sufferer is unable to discharge, and suffocation is threatened every moment. Now it is that the nervous stimulants, and stimulating expectorants are to be employed, while our antiphlogistic efforts must be confined to external revulsive measures. Decoction of seneka, assafetida by the mouth and rectum, carbonate of ammonia, valerian, musk, oil of amber, wine-whey, animal broths, and sometimes a little weak milk-punch, may be employed; the activity of the remedies being graduated according to the debility of the patient. An emetic may sometimes be employed advantageously even in this stage. It proves useful by aiding in the expectoration of the pulmonary secretion. But some substance should be selected which operates without producing prostration. Mustard, sulphate of zinc, or sulphate of copper, will best answer this indication. Externally, garlic and brandy may be applied warm to the breast and spine; and liniments or cataplasms of oil of turpentine, mustard, Cayenne pepper, ammonia, &c., may be resorted to, if necessary, to aid in the support of the system, until the offending cause is removed, or reaction established.

Dr. Fithian, of Woodbury, New Jersey, treats croup successfully by cold water, applied by means of towels to the throat and upper part of the chest.

The symptoms of the paroxysm are relieved, and, if they return, again give way upon a repetition of the application. (Report, &c., by Dr. J. G. Garrison, *M. J. Med. Reporter*, iii. 249.) The external application of tincture of iodine has been strongly recommended. (See *Am. Journ. of Med. Sci.*, N. S., xvii. 496.) Dr. Tracy, of Worcester, Mass., has found great advantage from keeping the patient in a *warm dry atmosphere*, from 80° to 90° F., and thinks he has successfully treated many cases in which false membrane had formed mainly by this remedy, though he conjoined the use of emetics and rubefacient liniments. (*Bost. Med. and Surg. Journ.*, xlv. 374.)

Treatment of Pseudo-membranous Croup.—In the forming stage of the disease, when it is still doubtful what may be the nature of the secretion, the treatment differs in no respect from that above detailed as applicable to the catarrhal variety. It is here only necessary to treat of the measures to be employed, after it has become obvious that the case is truly pseudo-membranous. In the first place, if, upon the occurrence of hoarseness and other symptoms of commencing croup, the fauces should be found covered with a coating of false membrane, recourse should be had immediately to cauterization by nitrate of silver, powdered alum, or muriatic acid, as recommended by Bretonneau. (See *Pseudo-membranous Inflammation of the Fauces*, p. 527.) The nitrate of silver is generally preferred, and a solution may be employed, varying in strength from two scruples to two drachms to the fluidounce of distilled water. The weaker solutions must be used several times a day, the stronger require to be applied once daily. The application should be extended to the borders of the glottis, which may be effected by means of a small piece of sponge fixed to a slender stick of whalebone, somewhat curved near the end. There may be some hope of arresting, in this way, the inflammation as it passes downward. It was formerly thought that, after the exudation had formed in the larynx, it would be useless to attempt the cure by cauterization; but experience seems to have shown that this cavity may be penetrated, without serious inconvenience, even in the infant; and cures have been effected apparently by this measure in several instances.*

Depletion, in this variety of croup, is much less efficient than in the catarrhal. The nature of the exudation does not depend upon the violence of the inflammation, but upon its peculiarity, or that of the blood, and this peculiarity is not modified by bleeding. This remedy has no effect in removing the false membrane already formed. The utmost that can be effected by it is to moderate the severity of the inflammation, and thus possibly diminish the amount of effusion. But there are many cases in which it is borne very badly. Such are those associated with scarlet fever, and epidemic diphtheritis or pseudo-membranous angina. The inflammation is here decidedly peculiar, and is scarcely diminished by bleeding, which, besides, endangers fatal prostration. The rule for the use of bleeding, in pseudo-membranous croup, is to proportion it as exactly as possible to the violence of the inflammation, and the vigour of the patient; regard being always had to the preservation of sufficient strength for those efforts, which will be necessary for the discharge of the offending matter from the air-passages, without which recovery can seldom take place. It should never be employed in low cases, nor in the last stage of the disease.

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* See communications by Dr. Wm. N. Blakeman, in the *N. Y. Journ. of Med.*, viii. 209; by Dr. Charles E. Ware, in the *Boston Med. and Surg. Journ.*, xxxvii. 417; and by Dr. James Bryan, in the *Medical Examiner*, N. S., iv. 342. See also cases in the *Am. Journ. of Med. Sci.*, N. S., xvii. 26, by Dr. Clark; and in the same, xxii. 85, by Dr. S. D. Townsend. Successful cases have since been recorded by Dr. Chapman, of Brooklyn, N. Y. (*N. Y. Journ. of Med. Sci.*, N. S., xii. 214), and by Dr. Kemp, of Baltimore (*Am. Journ. of Med. Sci.*, N. S., xxiv. 281).

Leeching is generally preferable to bleeding; as an equal amount of blood taken in this way has a greater influence on the local affection. I have seen bleeding pushed far in this variety of croup; but never, after the membrane had been clearly formed, with any obvious effect in ameliorating the symptoms. If it is to do good, it must be resorted to before the exudation has become extensive. Nor can much benefit be expected from blisters, except sometimes to the chest, in order to moderate bronchitis and prevent pneumonia. In the diphtheritic variety, the blistered surface is much disposed to slough.

The indications in the treatment of pseudo-membranous croup are, to prevent the further formation of false membrane; to effect the dissolution, absorption, or separation of that already formed; and to favour its expulsion. The most effectual method of meeting the first indication, after any violence of inflammatory excitement that may exist has been moderated by bleeding, is, beyond all comparison, to bring the system as speedily as possible under the mercurial influence. This, more than any other known means, modifies the peculiar nature of the inflammatory process, and consequently the character of the secretion, which, from being plastic, becomes mucous or puruloid and diffluent. This plan of treating croup originated with American practitioners. Dr. Rush recommends the use of calomel freely, in his Medical Inquiries. It has subsequently been pushed to an enormous extent in some parts of Europe. Three hundred grains are said to have been given in twenty-four hours. But this heroic practice is quite unnecessary. Only a certain amount of the medicine, after entering the stomach, can find access into the general system; and the remainder lies inert, or nearly so, in the bowels. It will be sufficient to administer to a child from two to four years old, first a purgative dose of four or six grains, and afterwards to follow this by from one to three grains every hour or two. I am not certain that the end would not be better accomplished, after effectual purgation by the first dose or doses, by giving a fraction of a grain, say one quarter, or one half of a grain every half hour. It would thus be less apt to purge, and more apt to be absorbed. After the production of green stools by it, further purgative effect should be avoided; and, should it then disturb the bowels, it should be combined with minute doses of the powder of opium and ipecacuanha. Its operation may be aided by mercurial frictions. Should any effect upon the mouth or salivary organs be observed, the remedy should be suspended. In young children, however, it very seldom salivates. It is said, in some cases, to have produced gangrenous ulcers in the mouth, and necrosis of the jaw-bones. I have not witnessed these effects; but, in cases of the desperate character of pseudo-membranous croup, a remedy must not be rejected on account of some hazard from its use. It should be employed with great caution in children of very feeble health, or of a scrofulous habit. Theory as to its mode of action is useless, in the present state of positive knowledge on the subject. It not only so modifies the secretory process as to prevent the production of false membrane, but, by causing a liquid secretion, favours the separation and possibly the solution of that already existing, and thus meets the second indication. It may even promote the absorption of the adhering exudation. There is every reason to believe that this process occasionally takes place; for cases having all the characters of pseudo-membranous croup get well, without the expectoration of false membrane; and dissection sometimes shows that portions of the exudation have been removed. We can sometimes even see the process going on, in the diphtheritic disease of the fauces.

Along with the mercurial, expectorant medicines should be given freely, to promote the loosening of the false membrane. Of these, tartar emetic and seneka are the most efficient; and they should be pushed as far as the patient's strength will admit.

To meet the same indications, the alkalies have been strongly recommended by some writers. They have been thought to dispose, like mercury, to mucous rather than to fibrinous secretion, and even to dissolve the secreted membrane, as they are known to do out of the body. The sulphuret of potassium, proposed by the author of a prize essay upon croup in France, had at one time the reputation almost of a specific; but has fallen into neglect. Cures, however, asserted to have been effected by it, are on record. It may be given in doses of from one to four grains every three or four hours. In overdoses it purges and vomits, and may produce dangerous effects. In reference merely to their alkaline properties, the carbonate or bicarbonate of potassa, soda, or ammonia would be preferable. I cannot speak of the effects of these medicines in croup from my own observation.

Dr. J. D. Griscom, of Philadelphia, relates a case in which the *iodide of potassium*, given in the dose of five grains every two hours, to a child between two and three years old, and continued for several days, had the apparent effect of modifying the plastic exudation, so that a gradual amendment took place, and the child ultimately recovered. (*Trans. of Col. of Phys. of Phil.*, N. S. ii. 164.) Mr. E. F. Sankey, of Sussex, England, relates a case in which similar advantage was *supposed* to be derived from *chlorate of potassa*. (*Lond. Med. Times and Gaz.*, July, 1852, p. 99.) Dr. Wm. Budd, of London, has obtained very encouraging success by keeping the child constantly immersed in warm vapour of from 75° to 80° F., and at the same time using emetics. (*Ibid.*, June, 1852, p. 614.)

To favour the expulsion of the membrane, which is the last indication, emetics are the most efficient remedies. Of these, ipecacuanha, tartar emetic, sulphate of zinc, and sulphate of copper, have been proposed. When the strength is considerable, the action decidedly sthenic, and the inflammation of a high grade, tartar emetic is the best; but, in the advanced stage, when the strength has begun to fail, sulphate of copper, or perhaps turpeth mineral, as proposed by Dr. Hubbard, would be preferable. Sulphate of copper has been highly applauded by some German practitioners, both as an emetic and alterative. It was introduced into use in croup by Hoffmann. I have seen it apparently very effectual in promoting the discharge of the false membrane. The dose as an emetic, for a child two or three years old, is half a grain or a grain, repeated every fifteen minutes till it operates, after which one quarter of a grain may be given every two hours. Alum, originally proposed by Dr. C. D. Meigs as an emetic in croup, is strongly recommended by his son Dr. J. Forsyth Meigs, upon the faith of frequent and advantageous trial. A teaspoonful of the salt, in powder, is to be given in honey or syrup, every ten or fifteen minutes till it operates. It is rarely necessary to give the second dose. One prominent advantage is that the emetic effect may be obtained several times a day, without exhausting the patient. (*Practical Treatise on the Diseases of Children*, by J. Forsyth Meigs, p. 46.) In relation to the general results of the emetic treatment in pseudo-membranous croup, it is stated by M. Valleix that, of fifty-three cases treated upon this plan, fifteen were cured; whilst of twenty-two cases in which emetics were omitted, or parsimoniously used, only one recovered. Of thirty-one treated by energetic emetics, twenty-six discharged false membrane through the effort of vomiting, and fifteen were cured. (*Rilliet and Barthez.*)

Sternutatories have been proposed in order to favour the expulsion of the false membrane, and may be tried. The same end is asserted to have been successfully attained by the affusion of cold water upon the whole posterior surface of the trunk. The remedy was proposed by Harder, and has been recommended by other German practitioners. It operates by the shock producing a powerful reaction. It is, however, applicable only to desperate cases. The water should be of the temperature of 53° to 55° F.

Reference has already been made to the cauterization of the larynx by solution of nitrate of silver. After an unsuccessful employment of other means, the practitioner would certainly be justified in resorting to this measure.

In the last stage, when the strength has become exhausted, our hopes must rest upon stimulants. The only chance for medical treatment is now to support the strength, in the hope that the false membrane may be spontaneously loosened and discharged. The remedies to be used are carbonate of ammonia, wine-whey, weak milk-punch or egg beat with wine, and spirituous fomentations externally. To quiet the extreme agitation of the patient, and give the other means employed opportunity to act more efficiently, it will be proper to place the system under the influence of antispasmodic and anodyne remedies, such as assafetida and opium, which may be conveniently given by injection. This practice was successfully resorted to by Dr. Isaac Parish, in a case recorded in the *Transactions of the College of Physicians of Philadelphia* (vol. ii. p. 277).

As a last resort, in cases otherwise desperate, tracheotomy may be employed. It is especially applicable to cases in which there is good reason to think that the false membrane does not extend into the bronchial tubes. This operation has been frequently performed by Bretonneau, Trousseau, and other French practitioners, and not without considerable success. Of twenty cases, Bretonneau saved six; and out of one hundred and twelve operations performed by Trousseau, twenty-seven were successful. In a memoir by Trousseau it is stated that, out of one hundred and fifty operations performed by different practitioners, thirty-nine ended favourably. But M. Trousseau recommends that the operation be performed so soon as it is satisfactorily established that the false membrane has formed in the larynx; and, in such cases, many cures might be cited which have been effected by medical treatment. It is, therefore, very difficult to determine upon the real value of the operation. If postponed until the case is otherwise quite desperate, it offers comparatively slender chances of success; if performed at an earlier period, it saves life, but possibly may do no more than can be accomplished in an equal or greater proportion by other means. Besides, in order to obtain its most favourable results, a degree of skill in operating is required, not to be found in practitioners generally. M. Trousseau finds necessary to success the application of topical remedies, such as the solution of nitrate of silver to the trachea, through the opening made into it, and moreover employs mechanical means to aid in removing, through the opening, the membranous matter which may exist in the windpipe. For detailed information on all points relating to tracheotomy in croup, the reader is referred to Memoirs by M. Trousseau in the *Dictionnaire de Médecine* (ix. 381), and in the treatise of MM. Rilliet and Barthez, on the diseases of infants (i. 367). In two out of three cases recorded by Dr. J. F. Meigs, in which the operation was performed by Dr. Jos. Pancoast, of Philadelphia, it was successful. In one of these, it afforded the only chance of safety. Instead of making a slit in the trachea and introducing a tube, Dr. Pancoast removed a small piece of the trachea itself, thereby superseding the necessity for the canula, and avoiding the danger of irritation from that source. (*Am. Journ. of Med. Sci.*, N. S., xvii. 307.)

General Points of Treatment.—The patient with croup should be confined to bed, should have flannel next his skin, and should be kept in the same temperature day and night. Great caution should be exercised, in the use of fomentations, cataplasms, leeches, and the warm bath, not to expose the skin while moist to the air. The diet should be farinaceous and mucilaginous, in the stage of highest excitement; when strength is wanted, milk may be employed; and, in the lowest cases, animal broths, jellies, &c. To prevent relapses, the clothing should be warm, and the child should not be transferred from a warm room in the day to a cold one at night. The custom of leaving the arms and breasts of infants uncovered is too great a sacrifice to fashion or to vanity. In children predisposed to the disease, the plan may be tried of gradually accustoming the skin to the impression of cold, by washing the shoulders and breast with water of the temperature of the air, beginning in the warm season, and continuing into winter, and taking care to avert any present unpleasant effect by wiping the part dry with a towel, and bringing about reaction if necessary by friction. When families are thus predisposed, especially to the more fatal form of croup, it may be advisable to remove to a mild and dry climate.

SUBSECTION II.

NERVOUS OR FUNCTIONAL DISEASES OF THE RESPIRATORY PASSAGES.

Article I.

LARYNGEAL NERVOUS DISEASE.

1. Infantile Spasm of the Glottis.—*Laryngismus Stridulus* (Good).—*Crowing Disease.*—*Inward Fits.*—*Spasmodic Croup.*—*Thymic Asthma.*—*Millar's Asthma.*—This disease, though similar to catarrhal croup in some of its symptoms, is essentially distinct in the circumstance, that it is purely nervous, and altogether independent of vascular irritation or inflammation of the larynx. There is much unfortunate confusion in its nomenclature. The description by Dr. Good of his *laryngismus stridulus*, though the name has been adopted by several writers for the disease in question, obviously also embraces catarrhal croup in some of its less inflammatory forms. The name of *spasmodic croup* is altogether inapplicable, as the disease is not croup at all. *Asthma*, however qualified by epithets, is equally inappropriate; as that is the name for a pectoral affection, while this complaint resides in the larynx. *Inward fits* is a vulgar title of the disease. The affection is usually characterized by a shrill sound in inspiration, somewhat like the crowing of a cock, which has given origin to the name of *crowing disease.* The sound is supposed to be owing to a spasmodic contraction of the chink of the glottis; and the complaint is confined to infancy and very early childhood, occurring at any time from a few days after birth to the end of the third year, but most frequently during the first dentition. Hence the name at the head of this article.

Symptoms.—The attack is sudden, and may occur at any time, though it is most frequent during sleep, from which the child awakes with a start, and in great apparent alarm. He is seized with inability to inhale the air; and the first symptoms are those of a struggle for breath, with the head thrown back, the breast elevated, the nostrils expanded, the mouth open, and all the muscles of inspiration in almost convulsive action. The veins of the neck and head are distended; and the countenance is flushed, swollen, and purplish, or of a pale cadaverous hue, with an expression of extreme anxiety and distress. At length, but occasionally not until symptoms of asphyxia appear, the spasm of the glottis somewhat relaxes, and the air rushes in, with a shrill, whooping sound. The child then usually begins to cry, and, after a short period of hurried breathing, returns to his previous health. But the stridulous sound during inspiration is not absolutely essential; for it sometimes happens that the spasm, instead of yielding partially, relaxes at once and completely, so as to allow the air to enter quietly. Not unfrequently, along with the difficulty of inspiration, there is a spasmodic contraction of the fingers and toes; and the paroxysm is sometimes followed by general convulsions. When the attack is over, the child is free from all symptoms of disease of the throat. Occasionally only a single paroxysm occurs at first, and the disease does not return for weeks. But the interval is often much shorter; and, in bad cases, the attacks take place several times a day, increasing in duration and frequency, until they occupy a quarter or half an hour at a time, and sometimes scarcely have an appreciable intermission between them.

The complaint is usually unattended with cough, fever, bronchial disease, or any appreciable inflammation of the larynx or trachea. By the absence of these affections it may be readily distinguished from croup.

Though often a trifling disease, it is sometimes far otherwise. In some instances, the child perishes with asphyxia from the persistence of the spasm. The interruption of respiration, when the fits are frequent, gives rise to a degree of cerebral congestion, which sometimes produces convulsions, or other serious morbid phenomena. But in general the complaint, when alarming, is so merely as a sign of serious disorder elsewhere. It is often rather a symptom than itself a disease. Though said by some writers to be frequent, it has been rare within the observation of the author.

M. Hérard, who saw much of the disease in the Children's Hospital at Paris, asserts that no characteristic morbid condition can be discovered after death. The emphysema, which he uniformly noticed, is an effect and not a cause. By this writer, spasm of the diaphragm is considered as sometimes forming an essential part of the affection, being the cause, in all cases, of the peculiar sonorous inspiration by which the disease is characterized, and which he states to be occasionally present without the spasm of the glottis. (*Med. Times*, Nov. 6, 1847.)

Causes.—The disease appears sometimes to depend upon a general morbid excitability of the nervous system, directed especially to the muscles of the glottis, which contract spasmodically from slight causes, such as the sudden contact of cold air, any quick unexpected movement, or vivid mental emotion, especially fright. Hence infants are sometimes attacked with it, when tossed playfully in the air. The act of swallowing occasionally brings on an attack. This morbid nervous irritability is most frequently owing to dentition; but it may also be produced by other causes which deteriorate the general health, such as impure and confined air, and unwholesome food. Attacks may be brought on by sources of irritation in the intestines, including undigested food, acidity, acrid secretions, and worms. Disorder in the alimentary canal is, indeed, believed by some to be its most frequent cause; and hence it is apt to occur in infants fed by the hand. In some instances, the disease is associated with, and probably dependent on, affection of the brain, and has been considered as one of the earliest signs of hydrocephalus. It has also been ascribed to inflammation of the cervical portion of the spinal marrow, and to tumours pressing on the par vagum, or the recurrent nerve, which regulates the movements of the glottis. Thus, it has appeared to arise from enlarged absorbent glands in the neck; and the thymus gland has been found of unusual magnitude in some fatal cases. Some authors consider the latter as among the chief causes of the complaint, which has therefore been named thymic asthma.

Treatment.—It is sometimes highly important to relax the spasm of the glottis at the commencement of the paroxysm, so as to prevent asphyxia. This may generally be accomplished by dashing cold water upon the face or shoulders, gently slapping the back, breast, or nates, blowing into the face or ear, or exposure to a current of cool air at an open window. When the spasm recurs frequently, it may often be prevented by the warm bath, nauseating medicines, and antispasmodics injected into the rectum. Should the symptoms be alarming, tobacco should be applied to the throat in the form of a cataplasm. It is said also to have proved very effectual in the form of enema, prepared with five grains of the tobacco and a fluidounce of hot water. Dr. F. Collins, of Wanstead, England, has employed the inhalation of chloroform, in several cases, with unfailing success. (*Lond. Med. Times and Gaz.*, April, 1853, p. 380.) But the practitioner must bear in mind the hazardous character of this remedy. Should the danger of death from asphyxia appear imminent, and no other remedy have proved availing, recourse should be had to tracheotomy, which could scarcely fail to rescue the patient for the time. But it must be very rarely requisite. Artificial respiration is recommended by Dr. Reid.

The general nervous excitability in which the complaint sometimes originates, should be controlled by the nervous stimulants, which have the property of equalizing the excitement. For this purpose, assafetida or valerian may be given internally, and garlic applied in the form of cataplasms to the feet, or with hot brandy to the spine. Narcotics may also prove useful, when the brain is not diseased, by diminishing the sensibility to exciting causes. Tonics and the cold bath, when the latter does not induce the spasm by the alarm it produces, are also useful by giving strength to the nervous system. Inhalation of the vapour of ether was effectual in a very bad case, recorded by Mr. Image, of the Suffolk Hospital, England. It was applied by means of a sponge held to the mouth and nostrils, at the commencement of each recurring paroxysm, which was thus instantly set aside; and at length the disposition to a return of the paroxysms ceased entirely. (*Prov. Med. and Surg. Journ.*, June 2, 1847.)

Attention should always be paid to the gums, which should be lanced if swollen and painful. When the dentition is peculiarly difficult and painful, blisters may be applied behind the ears, or at the nape of the neck.

The bowels should also be scrupulously attended to. If the stools are white, or otherwise disordered from deranged biliary secretion, minute doses of the mercurial pill or calomel should be given, or mercury with chalk if there is diarrhœa. Acidity must be corrected by the usual remedies. Should a tendency to constipation exist, it must be counteracted by rhubarb, magnesia, castor oil, or other mild cathartic, so as to obtain one or two stools daily. The diet should be very carefully regulated, and all indigestible or acescent food forbidden. The mother's milk is usually the best food under the year, and cow's milk with arrowroot, ground rice, &c., and animal broths in moderation afterward. The child should be clothed warmly, and made to breathe a free and pure air. Especial care should be taken to avoid all frights, and other sudden or violent emotions.

Should there be reason to suspect disease of the brain, or tumours pressing upon the par vagum or its recurrent branch, as the cause of the complaint, the remedies should be addressed to these affections.

2. Spasm of the Glottis in Adults.—Occasionally the glottis is spasmodically affected in adults, independently of inflammation. The same phenomena to a certain extent occur as in children. There is first difficulty with laborious effort in inspiration, then the shrill whooping sound arising from the entrance of air through the somewhat open but still contracted passage, and occasionally a croupy cough. The spasm may be excited, and sometimes fatally, by a foreign body in the larynx or pharynx. Choking is in such cases not mechanical; but arises from involuntary contraction of the laryngeal muscles, consequent upon irritation of parts supplied with branches of the same nerves. The affection results most frequently from an unstable and excitable condition of the nervous system, and is merely one of the protean forms in which hysteria exhibits itself. Sometimes it appears to have its origin in spinal, sometimes in cerebral irritation. It may also be produced by tumours pressing upon the recurrent nerve, as aneurism of the aorta and its primary branches. It is much more common in women than in men.

The treatment must be directed to the cause, and is for the most part such as is adapted to cases of hysteria. Antispasmodics, narcotics, tonics, the cold or shower-bath, a proper regulation of the intestinal and uterine functions, counter-irritation to the spine, an appropriate diet, and exercise in the open air, are the chief remedies.

3. Suppression of the Voice, or Aphonia.—Allusion is here made only to affections of the voice of a nervous character, independently of inflammation or organic alteration of the larynx. Changes of the voice of this kind are not uncommon. Sometimes it becomes acute, or of a higher key, though feeble. The voice of a man is thus rendered feminine, or puerile. Sometimes the alteration is of an opposite character, the voice becoming low, or hoarse, or croaking, so that a child or a woman will speak like a man. In many instances, it is entirely suppressed. No sound is formed above that of the breath, and speech is in whispers. The attack may be sudden or gradual, and brief or of long and indefinite duration.

Causes.—These are numerous. Among the most frequent is the irregular distribution of nervous influence consequent upon general debility, as after long continued or exhausting diseases. The affection is often nothing but a form of hysteria. Sometimes it depends upon debility of the laryngeal muscles alone; as where these have been overstrained by protracted and excessive efforts in speaking or singing. Occasionally an attack is brought on by a sudden and strong mental emotion, as of joy, anger, or fright. Quick changes from a warm to a very cold air have induced it. In some instances, it appears to depend on sympathy with intestinal irritation, or disease of the sexual organs, whether in man or woman. It has attended the poisonous action of lead, and has been brought on by powerful narcotics, as belladonna and stramonium. Another frequent source of it is disease affecting the par vagum or recurrent nerve, or one of the nervous centres. Hence it may attend aneurisms in the upper part of the chest, and, in the form of partial or complete palsy of the larynx, may depend upon congestion or effusion in the brain, or other organic cerebral disease.

Treatment.—When the disease depends on general debility, the obvious plan of cure is to restore strength by tonics, the cold bath, nourishing food, and exercise. When a mere form of hysteria, it is to be treated like spasm of the glottis from the same cause. If the brain is in fault, our remedies must be addressed to that organ, and must vary with the nature of the affection. Nux vomica or strychnia may be employed, when there is reason to suspect a paralytic state of the muscles of the glottis, without sufficient active congestion or inflammation of the nervous centres to contraindicate its use.

Aphonia arising from temporary causes often disappears spontaneously. When produced by cold, it is cured by hot teas, or warm stimulating drinks, given so as to produce perspiration. If the result of lead poison, it may be treated by mercury, and by measures calculated to stimulate the organ. Such measures are also obviously proper in all cases, where the modification of the voice depends on debility of the laryngeal muscles. Under such circumstances, we may employ gargles of alum and other astringents whether vegetable or mineral, stimulating inhalations, electricity or galvanism, external irritation by means of sinapisms, blisters, croton oil, or a seton, and strychnia applied to a blistered surface, or taken internally. Inhalation of the vapours of benzoin has been found effectual. Dr. Pancoast, of Philadelphia, has related two cases in which the voice was restored by inhalation of chlorine. (*Trans. of Am. Med. Association*, iii. 136.) The vapour of ether with balsam of Tolu has been recommended. Solution of nitrate of silver has been applied directly to the internal surface of the larynx, with success in several cases, by M. Trousseau; but the operation requires dexterity, and should be tried only by a skilful hand, and after a fruitless employment of other remedies.

4. Laryngeal and Tracheal Pains.—*Neuralgia of the Larynx and Trachea.*—Severe pain sometimes attacks these parts, without any evidence whatever of inflammation. It is felt along the anterior part of the throat, and beneath the upper part of the sternum. Like other forms of neuralgia, it may occur in paroxysms, or may be continuous for a considerable time, and varies greatly in degree. It may or may not be accompanied with spasm of the muscular fibres. The most frequent cause of it is probably rheumatic or gouty irritation, in constitutions of a nervous character. It may arise also from other causes of neuralgia elsewhere, as general debility, or irritation existing in the nervous centres, or in the course of the nerves supplying the parts. In persons predisposed to the affection, it is sometimes excited by breathing cold air. The remedies are the same as for neuralgia generally. Those especially applicable in this case would be the inhalation of warm aqueous vapour, either unmixed or impregnated with the vapours of narcotic and anodyne substances, such as opium, camphor, and conium; the smoking of tobacco or stramonium; and the application of a blister over the seat of pain, and the sprinkling of morphia upon the blistered surface. When apt to be induced by cold air, it may probably be best prevented by the habitual use of the cold shower-bath, or the frequent application of cold water to the neck and breast. An attack may sometimes be averted by holding a silk handkerchief to the mouth and nostrils, upon entering the open air.

Article II.

HOOPING-COUGH, or PERTUSSIS.

Syn.—Chin-cough.—Convulsive Cough of Children.—Tussis convulsiva, spasmodica, strangulans, &c.

This is a contagious disease, characterized by frequent paroxysms of coughing, in which the expiration is broken into numerous short, rapid, and spasmodic movements, and the inspiration is long, and frequently sonorous. It most frequently affects young children. Medical writers usually divide it into three stages; 1. the catarrhal or forming stage, 2. the spasmodic stage, or that of progress and maturity, and 3. the declining stage. The limits of these several stages are not always well defined, nor do they all exist in every instance of the disease. Something like them, however, is very generally observable; and the division enables the symptoms to be more conveniently grouped in description, than they could be without this or some similar arrangement.

Symptoms, Course, &c.—The disease generally begins, like a common cold, with coryza, red and watery eyes, sneezing, irritation of throat, a dry cough, and sometimes febrile symptoms; and it is often impossible to distinguish it, with certainty, at this period, from catarrh. The cough, however, has usually more of a paroxysmal character; and this circumstance, in connexion with the fact that the disease is prevalent at the time, is sufficient to fix suspicion upon the case, and put the practitioner upon his guard. This stage continues, in most cases, for one or two weeks, before decided spasmodic symptoms appear. Sometimes, however, its duration is shorter, and sometimes longer. Instances, indeed, now and then occur, in which the characteristic symptoms of the disease appear at the outset; and it is occasionally observed, during the prevalence of hooping-cough, that catarrhal affections run a corresponding course, as if dependent upon the same cause, though destitute of the peculiar spasmodic phenomena.

But, in most cases, at the end of eight or ten days, the cough begins to change, gradually assuming the proper character of pertussis; and the disease passes into the second stage. This, when fully formed, presents the following symptoms. At irregular intervals through the day and night, the child is seized with an irresistible disposition to cough. But the sound, instead of occupying continuously the whole time of expiration, as in ordinary complaints of the chest, is broken into a number of short coughs, which succeed each other with an almost convulsive force and rapidity; and the inspiration that immediately follows is long, difficult, and often attended with a shrill or whooping sound, which has given its common name to the complaint. This succession of spasmodic cough and shrill inspiration is repeated again and again, thus constituting a paroxysm, which lasts variously from thirty seconds to fifteen minutes, or even longer. During the paroxysm, the face is flushed, swollen, and sometimes purplish or livid, the veins of the neck and temples distended, the eyes prominent, and the countenance expressive of much distress. The child, if lying, starts up into the sitting posture, and, if standing, seizes some person or object near him for support. In violent cases, the blood sometimes escapes from the nose, mouth, or ears, or is extravasated into the tissue of the conjunctiva; and the urine and feces are discharged involuntarily. The paroxysm usually terminates with the expectoration of transparent mucus, and not unfrequently in vomiting, which appears to relax the spasm, and thus proves serviceable in the complaint. Occasionally, however, no discharge takes place from the lungs or stomach, and the paroxysm ceases with the exhaustion of the patient. For a short time after it is over, the child appears feeble and perhaps trembling, with hurried pulse and breathing; but he soon recovers from these symptoms, and seems as if nothing had happened, resuming his play or occupations with his ordinary cheerfulness, and often showing an eager desire for food, especially after vomiting. If asleep when seized with a cough, he lies down when it is passed, and is soon asleep again.

The successive broken coughs, so characteristic of the disease, are obviously the result of short and quick spasms of the muscles of expiration. This symptom not unfrequently occurs long before the whooping sound, which, in some few instances, is very seldom or never heard throughout the complaint. The sonorous inspiration, or whooping, is owing to the difficult passage of the air through the contracted and rigid chink of the glottis, as happens also in croup, and the crowing disease of children. The expectoration is probably produced, not by inflammation of the bronchial mucous membrane, but in consequence of the violent agitation of the lungs, which induces an increased afflux of blood and consequent increased secretion, exactly in the same manner as prolonged fits of laughter. The vomiting arises from the disturbed movements of the fauces, and seems to be a provision of nature for a solution of the paroxysm. There is no previous or subsequent sickness of the stomach.

The paroxysms recur quite irregularly, sometimes without apparent cause, sometimes from slight causes, such as exposure to cold air, sudden or rapid movements, crying, attempts at swallowing, fits of passion, irritating inhalations, and even the sight of others labouring under an attack. The period of their recurrence is very different in different cases. In some, there is only an interval of a few minutes between them, in others, they occur not oftener than eight or ten times in twenty-four hours; and there is every intervening degree of frequency. Authors do not agree upon the point, whether they occur oftener during the day or night; from which it may be inferred that there is no great difference in this respect. The patient is often sensible, for some time previously to the seizure, that it is about to take place. A tickling sensation in the larynx and upper part of the trachea, pains in the breast, and increased frequency of the pulse and respiration, often precede the paroxysm; and the child appears to dread its approach, and to repress the disposition to cough as long as possible.

The paroxysms increase in frequency and violence until the complaint is at its height, which is usually in four or five weeks from the commencement of the attack, though the time may be considerably shorter or longer. The disease then appears to remain stationary for about two or three weeks, after which it begins to decline, and the third stage commences. The spells of coughing now gradually become less frequent and severe, and more catarrhal, being attended with the expectoration of opaque whitish or yellowish matter, and losing much of the spasmodic or convulsive character. At length the broken expiration and the whooping sound cease entirely; and the patient is either well, or affected with a slight ordinary cough, which in its turn ceases. But not unfrequently the termination is much less regular. Sometimes the symptoms, after having ceased, reappear for a time. Frequently, after restoration to health, if the patient acquires a cough from any cause, it is apt to exhibit more or less of the characteristics of pertussis. Occasionally the disease seems to assume a chronic form, and is indefinitely protracted. Its duration is quite uncertain. Sometimes it has disappeared in a month or six weeks, while in other cases, it is asserted to have run on for two years. It will probably be no great deviation from the truth, to state that, in its ordinary course, the disease occupies about three months; six weeks being allowed for its formation and progress, two or three for its highest elevation, and three or four for its decline.

As above described, hooping-cough is in its simple uncomplicated form. Except the catarrhal symptoms at the commencement, it does not necessarily show any signs of bronchial inflammation. The patient runs about, often with a good appetite, and, except during the paroxysm, suffers little. There is no fever, or only an occasional slight accession, dependent probably on some temporary irritation of the bronchial or alimentary mucous membrane. Auscultation may sometimes detect the dry or mucous rales; but very often, as asserted by Blache from personal observation, it discovers no morbid sounds whatever in the chest. (*Dict. de Méd.*, ix. 27.) It is a curious fact, that, during the paroxysm, the respiratory murmur cannot be heard. The air does not enter the air-cells, either in consequence of the deficient quantity that is allowed to pass the glottis, or, what is very probable, from spasmodic closure of the small tubes. Immediately after the paroxysm, the ordinary sound of respiration is heard distinctly.

The force of the disease varies much even in its simple form. In some instances, it is so slight that it can scarcely be determined, after recovery, whether the child has had hooping-cough or not.* In others again it is very severe, with frequent and violent paroxysms, which seem to threaten suffocation. By the pressure upon the brain, fatal convulsions are sometimes brought on; and death may also take place from asphyxia during the paroxysm. A case of death is recorded from emphysema of the neck and mediastinum, consequent upon a violent paroxysm of coughing. (*London Lancet*, Aug. 1849.) In protracted cases, great emaciation and debility sometimes ensue, and the patient may die of exhaustion. But these results are comparatively rare. The simple form of the disease almost always terminates favourably. It is, however, liable to complications, which are very often dangerous, and not unfrequently fatal.

Of these complications the most frequent are probably bronchitis and pneumonia. When the child becomes steadily febrile, one of these affections may be suspected. It is not uncommon for the peculiar symptoms of pertussis to be diminished during their continuance, and to reappear upon their decline. A certain degree of bronchial inflammation is not unusual in the early stage, and for some time even after the spasmodic symptoms have appeared. But this is not often serious. That from which danger is most to be apprehended occurs at an advanced period of the disease. It may affect the larger tubes exclusively, or may penetrate into their minute ramifications. The symptoms and physical signs are the same as in bronchitis from other causes. Pneumonia very seldom occurs early in the complaint. Rilliet and Barthez state that they have not observed it in children who have perished before the twenty-seventh day. (*Malad. des Enfants*, ii. 216.) It is usually lobular, though it occasionally also affects large portions of the lung continuously.

Convulsions are another frequent complication of hooping-cough. They are most apt to occur during the period of dentition. They may be owing simply to an excessively excitable condition of the nervous system, induced by the two affections jointly. In this case, they are not necessarily very dangerous. A more serious form of them is that which occurs in consequence of congestion or effusion within the cranium, indicated by a rolling of the head, contracted or dilated pupil, squinting, paralysis of some portion of the body, and comatose symptoms. Occasionally they are the mere expression of a hydrocephalic condition of the brain; in which case they are almost necessarily fatal. (See *Tuberculous Meningitis* and *Hydrocephalus.*)

Croup sometimes complicates pertussis, and, if of the pseudo-membranous character, is greatly to be dreaded.

Still another complication is inflammation of some portion of the alimentary canal, indicated by fever of the remittent character, furred tongue, tenderness and sometimes swelling of the abdomen, diarrhœa, &c. The hepatic secretion is not unfrequently deranged.

When any predisposition to tubercles exists, these are very apt to be developed. Dropsical effusion sometimes attends pertussis. Various other diseases have been enumerated as occasional accompaniments, but their presence is in general merely accidental.

Taking into consideration all the complications of pertussis, it must be regarded as a disease calculated to excite solicitude, and a careful watchfulness. Great numbers die of it in every epidemic. It is most fatal in children under two years, probably because then combined with dentition. By comparing results stated by Dr. Condie, it appears that the average deaths from hooping-cough, in our Atlantic cities, are about one in seventy of the whole number of deaths from all diseases; while in various countries of Northern Europe mentioned, it is nearly one in thirty-four. (*Diseases of Children*, p. 325.)

Anatomical Characters.—After death, in uncomplicated cases, no other morbid appearance is observed than some signs of congestion of the brain, and a viscid mucus in the bronchia. But, as death very rarely occurs in such cases, there is seldom an opportunity of ascertaining their anatomical characters. It is scarcely necessary to say that the several additional affections of which patients may die leave their peculiar marks behind them, which are enumerated under the proper heads. One organic lesion it is proper to notice here, as a common attendant upon the advanced stages of fatal cases. The lesion alluded to is a dilatation of the bronchial tubes. This has been ascribed by some to pressure from violent coughing; but the explanation hardly appears probable, when we consider that the chief force exerted is in expiration. It is, I think, more justly attributed by Guersent and others to an increased nutrition under the stimulus of irritation.

Causes.—One of the most common causes of pertussis is certainly epidemic influence. But this is not so sweeping in its range, nor so rapid in its progress as the cause of influenza. Epidemic hooping-cough is more commonly somewhat partial in its prevalence, like measles and scarlatina, affecting only certain districts or cities, or even parts only of these, to the exclusion of other parts. Sometimes the disease attends an epidemic of measles, and is occasionally associated with the influenza in certain localities. It is altogether irregular in the periods of its recurrence. Its fatality is said to be much greater in some epidemics than in others. It is not confined to any season, though perhaps more frequent in cold than in warm weather. The disease is more favourable in spring than in autumn, because its latter stages, in which there is greatest danger of pectoral inflammation, are brought into the summer instead of the winter. Occasionally the complaint is sporadic. Different opinions have been entertained of its contagious nature; but the great majority of writers are united in believing that it is propagated from individual to individual; and it does not appear to the author possible to resist the weight of evidence in favour of this view. It is probably most contagious at the period of its highest developement.

As a general rule, the disease occurs only once in the same person. Exceptions occasionally happen to this rule, as in all other contagious diseases. It is confined to no age, sex, or condition of life. Persons advanced in life are sometimes attacked, and Dr. Watson mentions a case in which a child was born with it. For a very obvious reason, however, it is confined chiefly to early childhood. Being frequently prevalent and highly contagious, it attacks most persons early in life; and adults escape because they have once had the disease. It is said to affect infants less frequently before than after the commencement of dentition. But may not this be owing to the fact, that, upon the whole, very young infants are less exposed to the cause?

Nature.—Very different opinions have been advanced as to the nature of hooping-cough. Some consider it as essentially a variety of bronchitis; but this opinion is not tenable; because the best evidence exists, both from the physical signs during life and examination after death, that the bronchia are often wholly free from inflammation. Others again ascribe the phenomena to cerebral disorder, considering this to be the essential feature of the disease. But this opinion wants the support of facts. No proof whatever is afforded by the symptoms that the brain is chiefly disordered. It seems to the author very clear that the complaint is not wholly and exclusively either inflammatory or nervous. The cause appears to be capable of giving rise to inflammation of the air-passages directly; for this is often the first observable effect; and, when not sufficient immediately to induce inflammation, it strongly predisposes to that condition, as proved by the frequency of bronchitis and pneumonia in the latter stages. But it is not less certain that the same cause gives rise immediately to nervous disorder of the respiratory passages; for this not unfrequently exists without any inflammation whatever in the second stage of the disease, and, in a few instances, is the first effect produced. Usually the catarrhal and spasmodic, in other words the inflammatory and the nervous effects, exist in the same case, and not unfrequently conjointly; but the cause may operate exclusively in either of these directions; for cases sometimes occur in which the peculiar spasmodic phenomena are quite uncomplicated, while others have been observed, in all probability ascribable to the same epidemic cause, which have been catarrhal throughout. Some have ascribed the complaint to inflammation of the pneumogastric nerve, and have even found that nerve inflamed after death; but other close observers have searched in vain for this condition of things, through a long series of dissections.

Treatment.—In simple cases of hooping-cough, without violent symptoms, little treatment is requisite. It is probable that, in the majority of cases, the disease runs its course to a favourable termination, with very little, if any, interference on the part of the physician. In its severer forms, however, treatment is often highly useful in alleviating the symptoms, and, in complicated cases, is frequently indispensable to safety.

In the early stage, if the catarrhal symptoms are moderate, it will be sufficient to give a mild cathartic, as castor oil, magnesia, or the sulphate of magnesia, and afterwards small doses of ipecacuanha or antimonial wine, at short intervals. But, should fever be present, with signs of bronchial inflammation, it will be proper to administer a full purgative dose of calomel; three or four grains, for example, to a child two or three years old, to be followed by castor oil, if it should not operate freely. This cathartic may be repeated in a few days, if the febrile symptoms do not abate. When the bronchitis is very decided, with some pain in coughing, difficulty of breathing, and the sonorous or sibilant rale under auscultation, blood should be taken from the arm, or locally from the breast by leeches, or from both, according to the severity of the symptoms, and the age of the patient. But the practitioner should always remember, while depleting in this disease, that the loss of blood cannot check its course, and that sufficient strength should be preserved to bear the patient through. He will, therefore, take less blood than in cases of original inflammation having the same seat, and the same grade.

When the spasmodic symptoms appear, different remedies are required. They may be either such as by stimulating the nervous system tend to equalize its actions, and thus obviate the irregular distribution of influence which causes spasm, or such as diminish the sensibility of the nervous centres, and render them less susceptible to the exciting or irritating cause. Hence, the nervous stimulants or antispasmodics, and the narcotics, have been found useful. The former are, perhaps, upon the whole, preferable, as less likely to promote any pre-existing disposition to cerebral disease; but the two may often be happily conjoined. The use of these should not, as a general rule, be commenced with, until any existing fever or bronchial inflammation shall have been removed. When these symptoms linger in connexion with the spasmodic, it will be preferable to precede the antispasmodics and narcotics by occasional emetic doses of *ipecacuanha*, in violent cases every day or every other day, with smaller doses every two or three hours in the interval, so as to sustain a very slight degree of nausea. Should the bronchitis be considerable, and especially if croup should coexist, or be threatened, *tartar emetic* may be preferred to ipecacuanha, in reference both to its emetic and nauseant action. *Lobelia*, too, may be employed in the latter case with great propriety. The *daffodil* (Narcissus pseudo-narcissus), which has been recommended in hooping-cough, probably acts in the same way. Emetic medicines are useful by relaxing the spasm, depressing general arterial excitement, and promoting expectoration. They may be aided by the frequent use of *hot pediluvia* or the *warm bath*. When fever has disappeared, and the proper paroxysms of hooping-cough only remain, recourse may be had to the antispasmodics; and, if there be any doubt upon the point, the use of these may be combined with that of the emetic medicines.

By far the best of the nervous stimulants that I have employed is *assafetida*. It should be given in emulsion, in the dose of one or two grains to a child two years old, repeated three or four times a day, or, in severe cases, as often as every two or three hours. Though disagreeable at first, it soon ceases to be so; and it is not at all uncommon to see the little patient anxious for the repetition of his dose. It has been recommended also by injection, and, in the form of tincture, as an application to the spine; but these modes of administration are unnecessary, when it is supported well by the stomach. *Garlic* may be employed as a substitute for assafetida, when this is not at hand, or may from any cause be forbidden. *Strong coffee* is said to have proved very serviceable. Other antispasmodics, which have had more or less reputation in the complaint, are *musk*, *artificial musk*, *castor*, *valerian*, *camphor*, *ammonia*, *oil of amber*, *Dippel's animal oil*, and *cochineal*.

Of the narcotics, *belladonna* has the highest reputation. It appears, indeed, from much highly respectable testimony, both of European and American practitioners, to exercise a very powerful influence over the disease. Little good, however, can be expected from it until it has given some obvious sign of its action, as dryness of the fauces, vertigo, or dimness of vision; and it should therefore be pushed to this point. Dr. Samuel Jackson, late of Northumberland, in Pennsylvania, now of Philadelphia, who was one of the first physicians to employ the remedy in this country, and has found it very successful, insists upon the necessity of giving it so as to dilate the pupil. The dose for a child two years old is from the twelfth to the sixth of a grain of the extract, twice or three times a day to begin with, and gradually increased, if necessary, until it produces its peculiar effects. The uncertainty and occasional great strength of the extract render it advisable to begin with a very small dose. The same effects may be obtained from the external, as from the internal use of the medicine. The most convenient mode of applying it is in the form of a plaster between the shoulders. I have seen a plaster of this kind act like a charm in relieving the symptoms of pertussis; but alarming convulsions came on; and, though these ultimately yielded, and the patient recovered, I have since been very cautious in the employment of the remedy. The connexion, however, in this case, may have been merely accidental.* Various other narcotics have been employed in hooping-cough. Among them are *opium*, *hyoscyamus*, *conium*, *extract of Lactuca virosa* or *lactucarium*, and *dulcamara*. Opium is undoubtedly the most efficient in allaying cough; but is liable to the objection of being apt to check mucous secretion, and consequently to prevent expectoration. Still, it may be occasionally used with advantage in connexion with ipecacuanha or tartar-emetic, and other expectorants. It has been recommended, in the form of one of the salts of morphia, as an endermic application to the throat. *Hydrocyanic acid* has been very highly praised. It does, in fact, appear to exercise a favourable influence in the disease; but its strength is so uncertain, and it is so dangerous in overdoses, that it is scarcely an advisable remedy, especially when we have so many others much safer, and not less effectual. Cherry-laurel water, the properties of which are identical with those of hydrocyanic acid, has been used in Europe, both by the mouth and by inhalation.

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* See a paper by Dr. Hiram Corson, of Montgomery Co., Pennsylvania, in which this remedy is asserted to be extremely efficacious in shortening the disease, and numerous cases are adduced in proof of the fact. (*Am. Journ. of Med. Sci.*, N. S., xxiv. 353.)

The tonics, which often prove efficient remedies in the purely nervous affections, have enjoyed some reputation in the treatment of this, especially at a somewhat advanced period, when the system has begun to be exhausted by the continuance of the disease. The mineral tonics have usually been preferred. Of these, *oxide of zinc*, in the dose, for a child two years old, of from half a grain to two or three grains every three or four hours, *subcarbonate of iron* in the quantity of from ten to fifteen grains in twenty-four hours, *iodide of silver* in the dose of one-quarter of a grain three times a day, and *nitrate of silver* in that of one-fifth of a grain daily, have been especially commended. Nitric acid, recommended by Dr. Arnoldi, is affirmed by Dr. G. D. Gibbs, in his treatise on hooping-cough, to "shorten the disease almost as effectually as quinia does intermittent fever." (See *Lond. Med. Times and Gaz.*, July, 1854, p. 118.) Among the substances which have enjoyed more or less reputation, *sulphate of quinia* has also been considerably employed, and probably quite as effectually as the mineral tonics.

We should perhaps be no great losers, were we to confine ourselves, in the treatment of the first two stages of hooping-cough, to the remedies already enumerated. The practitioner will select from among them those which he may deem most efficient, and variously combine them to answer different indications. Thus, in the earlier stages, when the catarrhal symptoms linger, the emetics may be combined with the antispasmodics and narcotics; in the latter stages, when debility has supervened, tonics may take the place of emetics; and in all stages, should the bowels be confined, and the medicines employed to meet other indications not have the effect of opening them, *laxatives* should be added to the other remedies. On the whole, of the emetics I should prefer ipecacuanha, of the antispasmodics assafetida, of the narcotics hyoscyamus, belladonna, or opium, of the tonics sulphate of quinia, nitric acid, or one of the chalybeates, and of the laxatives, castor oil, rhubarb, or magnesia. In connexion with this course of medicines, occasional recourse may be had with advantage to the *antacids*, when the stomach or bowels are disordered; and hence the preference given to magnesia as a laxative. But, when laxatives are not required, the carbonates or bicarbonates of soda and of potassa should be used. These have had much reputation in hooping-cough independently of their antacid properties, and have been considerably used in liquid mixtures with cochineal. If to the above measures we add the use of the *warm-bath*, for half an hour, an hour, or even two hours at a time, in bad spasmodic cases, when the paroxysms are very frequent and distressing, we shall have completed the round of desirable remedies.

Nevertheless, it will be proper to allude to others which have been strongly commended; as some of them may undoubtedly be occasionally useful, and the practitioner may know where to resort, when he has ineffectually exhausted the usual remedies. Among those of mineral origin may be mentioned, *solution of arsenite of potassa*, *iodide of potassium*, *acetate* and *sub-*

acetate of lead, *alum*,* *sulphur*, and *sulphuret of potassium*; among the vegetable, *tannic acid*, the *misletoe* of the oak, in the dose of ten or twelve grains to a child, and *nux vomica*; and of the animal, *tincture of cantharides*. Local irritation by blisters, tartar emetic, &c., has had strenuous advocates, though in general it is in little favour, unless in cases of obvious inflammation, whether pectoral, encephalic, or abdominal. Pustulation by tartar emetic is hazardous, and a case of death from this cause, consequent upon sloughing and ulceration, is recorded. (*Dict. de Méd.*, ix. 41.) *Inhalations* have also been resorted to, and promise some temporary benefit. The substances used in this way, among others, have been *cherry-laurel water*, added in the quantity of a fluidrachm to the warm water employed, camphor, tar, benzoin, galbanum, nitrous acid vapours, &c. Ether and chloroform have recently been recommended, and the latter is stated to have been used with great advantage; but it requires much caution, and, in consequence of the occasional fatal results of its inhalation, should not be resorted to unless to save life, which can seldom be necessary in this complaint. Dr. E. Watson, of Glasgow, recommends the application of a strong solution of nitrate of silver to the interior of the larynx, as in cases of chronic laryngitis; having cured the complaint, in several instances, by this remedy. (*Ed. Month. Journ. and Retrosp.*, Dec. 1849, p. 1290.) *Vaccination* appears to have exercised a decided influence in modifying or arresting the disease, and may therefore be resorted to, in cases in which the child has not yet undergone this process. Dr. R. L. Madison, of Petersburg, Va., believing the disease to originate in irritation of the spinal cord near the orifices of the pneumogastric and phrenic nerves, treats the disease with a blister to the back of the neck, and finds this remedy to prove speedily and permanently effectual. In most cases, a single application is sufficient to effect a cure. (*N. J. Med. Reporter*, v. 124, from the *Western Lancet*.)

In the declining stage of the disease, the same remedies may be employed as previously, in gradually diminishing quantities, as the peculiar symptoms decline. Should a troublesome cough remain in this stage, it may be treated with the stimulant expectorants, combined with opium or hyoscyamus, as in chronic bronchitis. Debility must be counteracted by the moderate use of tonics. But what is chiefly required is care to avoid causes of inflammatory attacks, to which the child is now very liable.

Should convulsions occur in the course of the complaint, without fever, heat of head, or other signs of dangerous cerebral disease, assafetida should be given by injection, garlic poultices applied to the feet, frictions with garlic and brandy made along the spine, and the body immersed, if necessary, in a warm bath. Should they be simply threatened, the same use may be made of garlic, while assafetida or Hoffmann's anodyne, with or without a little laudanum or paregoric elixir, may be given by the mouth. If the convulsions are connected with symptoms of cerebral congestion, it will be necessary to apply leeches to the temples, cold to the head, a blister to the back of the neck, and stimulating applications to the feet. In such cases, narcotics must be avoided. A bolder practice would be indicated, should the symptoms threaten an attack of meningitis. (See *Meningitis*.) Severe bronchitis or pneumonia must be encountered by the remedies demanded by these affections occurring originally; except that bleeding should be less freely employed.

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* Drs. J. F. Meigs and D. F. Condie, in their respective works on the diseases of children, speak very decidedly of the efficacy of alum. Dr. Meigs has found alum more efficacious in moderating the violence of the disease than any other remedy that he has used. (*Note to the fourth edition.*)

The most efficient remedy, under these circumstances, next to a due amount of depletion, is calomel given in purgative doses, daily, every other day, or twice a week, according to the severity of the symptoms. In cases of fever connected with irritation or inflammation of the primæ viæ, leeches to the abdomen, emollient cataplasms, refrigerant diaphoretics, warm baths, demulcent drinks, mild aperients, as rhubarb and magnesia, and sometimes small doses of calomel, are suitable remedies.

Throughout the complaint, there are various points of regimen and management which require attention, independently of the use of medicines. One important rule is, that, when very young, the patient should be sedulously watched; as there might be danger of strangulation in the paroxysm. The infant, as soon as the cough begins, should be raised to the upright position; and, at the close of the paroxysm, the nurse should remove by her finger the mucus which is thrown up into the fauces. The violence of the paroxysm may sometimes be abated by inducing the child to drink a little cold water, or some cool demulcent beverage; and, when suffocation is threatened by the violence of the spasm, this may often be relaxed by dashing a little cold water into the face, or, according to Williams, by blowing into the ear. The bowels should be carefully regulated, and the biliary secretion, if deranged, corrected by appropriate means. During dentition, the gums should be carefully attended to. If swollen, they should be lanced freely; and, if they still remain inflamed and painful, a few leeches may be applied near the angle of the jaws, and blisters behind the ears. The diet should vary with the stage and the degree of excitement. It should consist, in the early stage, chiefly of vegetable substances with or without milk; at a more advanced period, of the same materials with milk freely, and a little of the lightest [illegible] meat, as the boiled breast of fowl, soft boiled egg, &c.; and, in the end, when the patient is debilitated, of the most nutritious food. Whatever is taken should be of easy digestion. Should inflammation at any time supervene, the diet should be strictly vegetable. The child should always be clothed with flannel next the skin. In the catarrhal stage, he should be confined to a uniform temperature; but, when the disease has become purely spasmodic, frequent exposure to fresh dry air, even in winter, is not only allowable, but often highly useful. Damp should always be avoided. In protracted cases, or those with a tedious convalescence, the cure is much promoted by a change of residence, as from town to the country, or from one part of a town to another; and, in the winter season, great good may be expected from removal to a warm climate.

Article III.

NERVOUS COUGH.

Now and then we meet, both in children and adults, with a cough which cannot be referred to any recognized disease. It is not attended essentially with any of the symptoms of catarrh. There is no evidence whatever of inflammation, or even vascular irritation in any part of the respiratory passages. None of the morbid sounds, whether of the dry or moist character, are necessarily detected in the chest. It is obviously a purely nervous affection; but it does not run the course, and is seldom attended with the peculiar symptoms of hooping-cough. It is the characteristic, and sometimes only observable sign of a peculiar morbid condition of the respiratory nerves, or their centres, and deserves to be ranked among diseases.

The cough is almost always dry, unless in instances in which, after a violent paroxysm, some mucus is thrown up, consequent upon the excitement of the respiratory organs, in the same way as expectoration results from a paroxysm of laughter. In other respects, it is liable to all possible variations. It is sometimes single, short, and at uncertain and distant intervals. Sometimes it is almost incessant, leaving the patient scarcely any rest for days and weeks together, except when interrupted by sleep. I have known a young lady affected with it in this form for months, with occasional intervals of brief duration. In this case, it had a uniform character, continued evenly onward, sometimes almost as regularly as the breathing, and had a peculiar loud, hollow sound, which could often be heard in the adjoining house. In such cases, it is occasionally interrupted by any cause which strongly engages the attention, or excites the feelings. It is even checked for a time by eating. In other instances, the cough assumes a paroxysmal character, sometimes approaching to hooping-cough, and occasionally scarcely distinguishable from that affection. When of this form, it is apt to occur in the night, and I have known it to prove extremely troublesome by interrupting sleep. Not unfrequently it bears so close a resemblance to the cough of the earlier stages of catarrh, as to be distinguished only by the absence of the other characteristic symptoms of that affection, and by resisting the remedies to which it very generally yields.

The cause is not always evident. The disease is most common in women and children, though it may occur also in adult males. It is often, no doubt, the result of an hysterical condition of the nervous system, and I have seen it associated with tenderness of the spine between the scapulæ. I have seen it also apparently the result of gouty and rheumatic irritation. Very frequently such a cough proceeds from gastric or other abdominal disorders, probably in consequence of the nervous connexions of the abdominal viscera with the larynx, through the medium of the par vagum and sympathetic. Sometimes it probably depends upon primary or secondary organic disease of the par vagum or recurrent nerve. But there are many cases in which the cause of it cannot be traced.

When not associated with any other disease, it almost always either subsides spontaneously in the end, or yields readily to remedies. In the uncomplicated affection, I have found nothing so effectual as assafetida. To this remedy it will often give way immediately, after having long resisted all the treatment usually applied to catarrhal affections. The other antispasmodics are also more or less efficient; and musk, so powerful as a remedy in hiccough, may be expected to be very useful here. Garlic, externally and internally, may be used advantageously, especially in the cases of young children. The narcotics may also be appealed to, and the warm bath will be found beneficial in cases of a spasmodic nature. Leeches or cups to the spine, followed by the tartar emetic plaster, are most to be depended upon in hysterical cases; and wine of colchicum with morphia, in those of a rheumatic or gouty origin. When the cough is a mere attendant upon dyspeptic or other abdominal disease, it yields with the cause which produced it. General debility, if existing, must be corrected by the usual means.

Article IV.

ASTHMA.

Syn.—Spasmodic Asthma.

Asthma, as the term is here employed, is a disease characterized by great difficulty of breathing, occurring in paroxysms, and depending on spasmodic constriction of the bronchial tubes, without the necessary accompaniment of fever, or organic disease of the lungs or heart.

The name has been very indefinitely applied. It would seem often to have been used synonymously with dyspnœa; but this use of it is clearly incorrect. Dyspnœa is not a disease; but a mere symptom, which may occur in various diseases; and, indeed, is occasioned by whatever interferes, in any way, with the due arterialization of the blood in the lungs. Compression of the air-cells, as in pleuritic and pericardial effusion; solidification of the pulmonary tissue, as in pneumonia; excess of liquid secretion in the bronchial tubes, as in bronchitis; loss of the substance of the lungs, as in phthisis; mere congestion of the lungs, as in cardiac diseases; and even deficient innervation, as in various malignant affections, may all produce it. Frequency of the pulse is as much a disease as difficulty of breathing. The latter, therefore, is not asthma. Formerly, in consequence of deficiency in the means of diagnosis, many cases of dyspnœa could not be traced to their real origin in organic diseases of the chest, and were thrown together into the same category with true asthma, because it was not known where else to place them. This difficulty is now removed; and we are enabled, by the methods of auscultation and percussion, to refer difficulty of breathing, not truly asthmatic, to its proper source, and thus to give greater precision to our conceptions of this disease.

The pathological condition proper to asthma, is that constriction of the bronchial tubes which sometimes occurs independently of inflammation or other organic lesion, and even of congestion, and which, though not positively demonstrated to depend upon muscular contraction, is generally believed to do so, and is therefore considered as spasmodic. But every case of constriction of this kind is not included in asthma. Bronchial spasm is a frequent and subordinate attendant upon other diseases of a much more serious character, as in cases of severe bronchitis. The inflammation is here the prominent affection; the one from which danger is apprehended, and to which treatment is directed. It would be as inappropriate to rank such cases with asthma, as to give the name of colic to every painful spasm of the bowels, attendant upon enteritis. It is only when the spasm, whether in the respiratory or alimentary passages, is the predominant affection, that it is entitled to rank as a disease, and take the name, in the one case, of asthma, and in the other, of colic. Those cases, therefore, even of spasmodic and paroxysmal dyspnœa, in which bronchial inflammation is the most important constituent, are not, in this work, treated of as examples of asthma, but are referred to bronchitis. (See *Bronchitis.*) In some instances, there is reason to believe that asthma is purely nervous or functional, and quite independent of any other disease; but it is probably more frequently associated with some degree of bronchial inflammation or other organic affection, which serves to call it into action. In the latter case, it does not lose its claim to be considered as the disease, so long as the exciting cause is merely subordinate.

Symptoms, Course, &c.—The asthmatic paroxysm is often preceded, for a

longer or shorter time, varying from a few hours to several days,
premonitory symptoms, which warn the experienced patient of its
Among these symptoms are languor, heaviness of the head, drows
headache, flatulent distension of the stomach, loss of appetite, strictur
the lower part of the chest, and sometimes the copious discharge of
urine. In some instances, however, the attack is sudden and without w
ing. It occurs generally in the night, most frequently between bedtim
two or three in the morning. The patient starts out of sleep into an
posture, with a feeling of tightness or compression of the chest, and g
difficulty in breathing. The air seems as if excluded from the lungs.
violent and even convulsive efforts of the muscles of inspiration are ma
order to expand the chest. A peculiar wheezing noise is made in breath
which can be heard at a considerable distance. Yet, notwithstanding
expansive efforts of the muscles, the chest sometimes appears contracte
consequence of the shrinking of the lungs, and a hollow in the epigastriu
produced by the unusual elevation of the diaphragm. Expiration is n
less difficult and painful than inspiration. Under a sense of impending s
cation, the patient is irresistibly impelled to seek for cool and fresh air.
the least semblance of restriction in this respect is insupportable. He in
that every avenue for the entrance of air should be opened; and often r
to the door or window, and even leans over the window-sill with his head
trunk projecting, in the vain search of breath. It is surprising how long
body is sometimes thus exposed, very imperfectly covered, to the cold a
winter, without any injurious consequence. But a similar impunity is
known to attend exposure, under other forms of great nervous exciten
The countenance of the patient, and his general movements express an i
scribable anxiety and distress. It seems to him as though he could
possibly live. A common and characteristic position is with the elbows
the knees, and the head between the hands. There is occasionally an atte
to cough; but it is imperfect, in consequence of the impeded respiration. Sp
ing is equally imperfect and difficult. The pulse is often small, feeble,
gular, and frequent, with palpitations of the heart; but occasionally both
pulse and the actions of the heart are nearly or quite healthy. The fa
either pale or flushed, or one and the other alternately; the eyes are pr
nent; the extremities often cool; and the head and breast covered with a
sweat. The urine, during the paroxysm, is pale and abundant, but, at
close, becomes scanty and high-coloured, and sometimes deposits a cop
sediment. The bowels are, in some instances, suddenly relaxed at the be
ning of the attack. After two, three, or four hours, the symptoms gradu
subside, usually with a copious expectoration of mucus, though someti
without this accompaniment. In the latter case, the disease is someti
called *dry asthma*, in the former, when the expectoration is abundant, *hu*
or *humoral asthma;* though the latter name is more frequently applied
variety of chronic bronchitis already described. (See *Bronchorrhœa*, p. 8
After the subsidence of the paroxysm, the patient usually falls into sleep,
upon awaking in the morning, feels himself comparatively well.

But the symptoms do not wholly disappear. Soreness of the muscles,
occasionally neuralgic pains are experienced. Some feeling of constricti
and perhaps a little wheezing, continue through the day; and the dyspnœ
greatly increased by muscular exertion, and by the horizontal posture.
patient often complains of weight and distension of the stomach after eati
and of other dyspeptic symptoms. In the following night, another paroxy
occurs with the same symptoms as the first, and with the same declens
towards morning. This alternation of exacerbation at night and remiss

in the day is repeated for several days, usually less than a week; when the paroxysms, which have been gradually abating in violence, cease altogether, and leave the patient in his ordinary health. There is still, however, some occasional dyspnœa; or at least this condition is brought on by causes which have no such effect upon other persons, showing the existence of a morbid predisposition.

Early in the course of asthma, there is often no return of the phenomena above described for a long time. A year, or even several years may elapse, before the patient experiences another succession of paroxysms; but more frequently they return at the end of six, four, or two months, and sometimes recur monthly, though the interval is seldom regular. In general, they increase in frequency with the duration of the complaint; till at length, in some instances, they are brought on by the slightest causes, and the patient is never free from the danger of an attack.

In relation to the *physical signs*, percussion is usually clear throughout the chest during the paroxysm, when there is no complication; but, notwithstanding the violent efforts at inspiration, the ear applied to the thorax is sensible of little sound from the entering air; only a faint respiratory murmur, and occasionally a degree of sibilant or wheezing sound being heard. Towards the end of the paroxysm, a temporary relaxation of the constriction appears now and then to take place, during which the respiratory murmur is heard as in health, but it soon becomes faint again. My young friend, Dr. Fitzwilliam Sargent, informs me that, in several cases of asthma, he has observed that, towards the close of inspiration, or even after this has apparently ceased, sibilant and sonorous rales begin to be heard, and soon spread all over the lung, denoting that the spasm of the smaller tubes has yielded to the pressure of the air; and the same sounds are continued through the expiration. According to Laennec, if a patient be induced to hold his breath for a short time, or to count aloud as many numbers as possible without stopping, and then quietly to commence breathing again, the spasm appears to be in a manner surprised into relaxation, and the air can be heard entering all parts of the lungs for the next breath or two, after which the ordinary state of things returns. This phenomenon may be considered as characteristic of spasmodic constriction of the bronchia. Forbes states that, during expiration, sound is perceptible over the whole chest, even in the extreme points of the lungs; not the sound of healthy respiration, but a loud sibilant or dry sonorous rale, corresponding with the wheezing noise usually heard in the paroxysm. (*Cyclop. of Pract. Med.*) According to Williams, the same diminution of respiratory sound is found in the intervals as during the paroxysm, though in a less marked degree; and a similar relaxation, upon holding the breath, shows that the affection is still spasmodic. (*Tweedie's Syst. of Pract. Med.*)

When asthma is uncomplicated, it often continues for a great length of time without materially impairing the health in other respects; and patients sometimes carry the disease into extreme old age. It has, indeed, been thought by some to contribute to longevity by warding off other affections; but this may well be doubted. Very often it is associated with organic diseases, either accidental, or standing towards the asthma in the relation of cause or effect. The most frequent of these are diseases of the heart, and emphysema of the lungs. It is easy to understand how either of these may be the result of asthma. The pulmonary circulation being impeded by the constricted state of the bronchia, the blood accumulates in the right cavities of the heart, which may thus suffer dilatation and hypertrophy. As to emphysema, the expansion of the chest, under the convulsive action of the muscles of inspiration, while the constriction of the bronchia lessens the general bulk of the lungs, and impedes the entrance of air from without, causes that contained in the vesicles to expand, and thus to produce their dilatation. When, in asthma, near the commencement of the disease, the intervals between the paroxysms are free from dyspnœa, should emphysema come on, it may be safely considered as a result of the spasmodic affection.

Appearances after Death.—It is asserted that, in many instances, no lesions have been found after death in asthmatic patients, which could account for the disease. But, as the uncomplicated cases scarcely ever prove directly fatal, there is little opportunity for making the requisite examination, unless in instances in which the patient is carried off by some other accidental malady. Hence it happens that, in persons reported to have died of asthma, a great variety of lesions have been observed, of which it is often impossible to say whether they had any essential connexion with the disease, or if so, whether the connexion was that of cause or of effect. The only organic affections which must be regarded as direct causes of the asthmatic symptoms, are lesions of the brain, spinal marrow, or par vagum, either original or consequent upon neighbouring tumours. All these are occasionally observed.

Causes.—A peculiar predisposition is generally necessary to the production of asthma by the ordinary exciting causes. These causes may operate in equal degree upon great numbers of individuals, and yet occasion asthma in but a very few. What is the nature of this predisposition, it is not easy to determine. The most that can be said is, that it consists in some inappreciable modification of the nervous constituents of the bronchial tubes, or of the par vagum, or of one or more of the nervous centres, the influence of which is extended to the respiratory apparatus.

The predisposition is sometimes hereditary. The congenital shape of the chest, or of the glottis, has been supposed to have some influence in its production. I believe that it is often connected or identical with the gouty or rheumatic diathesis; and that the paroxysm is nothing more than an attack of nervous gout or rheumatism, affecting the respiratory organs. A certain general mobility or excitability of the nervous system, such, for example, as occurs in hysteria, may be supposed to be favourable to the production of an asthmatic predisposition. Indeed, asthma is sometimes probably nothing more than hysteria in the lungs. It may occasionally be traced pretty clearly to spinal irritation, indicated by tenderness upon pressure of one or more of the spinous processes. A similar condition of the nervous system may possibly be induced by causes of an exhausting or debilitating nature, such as excessive venery or masturbation, habitual mental depression, habitual indulgence of any of the stronger passions, profuse evacuations, protracted illness, and the different forms of dyspepsia. It is said that persons much exposed to irritating inhalations, whether in the form of gas, vapours, or dust, are peculiarly liable to asthma. I suspect that, except in cases in which the predisposition has existed, the result of these causes has rather been bronchitis, attended with more or less bronchial spasm, than true asthma. Another predisposing cause is said to exist in those professions which require in their exercise violent and continued respiratory efforts; but, with the same exceptions as above stated, it is highly probable that the dyspnœa is in these cases ascribable to emphysema of the lungs. It is difficult to determine how much influence climate may have in the production of the asthmatic predisposition. The disease would seem to prevail most in moderately cold and moist regions; though it is said to be frequent also in very cold and very hot climates. But the accounts of writers are somewhat contradictory on this point.

All ages are liable to the disease; but it is most common in middle age, rarely attacks young children, and, though occasionally found in the old, seldom originates in advanced life. It is more frequent in men than women, except in old age, when it is said to prevail about equally in both.

Of the exciting causes, the most frequent is probably cold. Hence, the paroxysms are most frequent in winter. Exposure to a very hot air, and the hot bath sometimes induce them. It is said that asthmatic patients are peculiarly apt to suffer from dyspnœa immediately before a thunder-gust, when the atmosphere is highly charged with electricity. Patients are sometimes affected by what appear to be whimsical causes. Thus, the change from light to darkness, the removal from one apartment to another not obviously different, an alteration in the direction of a journey, the shutting of a door, the very alarm of an expected paroxysm, are said to have induced attacks. With one patient a cold dry air agrees best, with another a damp air; some can breathe only a pure atmosphere, others prefer the smoky and contaminated air of cities. There can be no doubt that the imagination has much to do in directing the agency of various reputed causes. Irritating substances, whether aëriform or solid, may excite the paroxysms when inhaled. In peculiar idiosyncrasies, certain odours, as that of ipecacuanha, and of new-mown hay, produce violent attacks of dyspnœa, which are sometimes of the asthmatic character. Anything capable of irritating the bronchial mucous membrane may excite a paroxysm. The suppression of hemorrhages or other habitual discharges, the sudden disappearance of cutaneous eruptions, the retrocession of gout or rheumatism, and various derangements of stomach consequent upon dyspepsia, especially flatulence, are enumerated among the causes.

True asthma is occasionally found associated with organic diseases of the thoracic viscera. More frequently these induce ordinary dyspnœa, with or without some spasm of the respiratory passages. In order that they may cause asthma proper, they must act on a predisposition to that complaint. Perhaps not one case in one hundred of the difficulty of breathing consequent upon pulmonary diseases deserves to be called asthma. In producing this disease, they must act either by a direct irritation to the bronchial mucous membrane or the nerves which supply it, or by producing congestion in the membrane, and thus secondarily acting upon its peculiar nervous susceptibilities. Tubercles and other tumours in the lungs may operate in the former mode, diseases of the heart in the latter. It has been already explained how emphysema of the lungs, which is a frequent accompaniment of asthma, may be the result of that affection. We may easily conceive how it may occasion dyspnœa; but it is not so easy to understand how it can give rise to the asthmatic paroxysm. When the two complaints, therefore, are associated, if there be any relation of cause and effect between them, the probabilities are altogether in favor of asthma as the cause. Bronchitis is another complaint very often connected with asthma; and is perhaps the most frequent accompaniment. The same cause which excites the one, will be very apt also to excite the other; and their coincidence is, therefore, not remarkable. It is not at all unlikely that the inflammation, once established, may have a tendency to sustain the spasmodic constriction of the bronchia, and thus far act as a cause of asthma in the predisposed. Should the inflammation be very violent, it would constitute the main disease; should the spasmodic symptoms preponderate, they would class the case under asthma; and there are occasional instances in which the two are so nearly balanced, that it would be impossible to decide in which category the particular case should be placed.

It is impossible not to be struck with a strong analogy, in certain respects, between asthma and gout. The apparently constitutional nature of the complaints, this disposition of the attacks to recur at distant but gradually diminishing intervals, the division of each attack into nightly paroxysms with marked remission in the day, the duration of the early spells for several days or a week, and the general incurability of the affection, are circumstances calculated to induce the suspicion that the two diseases are often identical; in other words, that asthma, as before stated, may often be nothing more than gout in the nervous form.

Prognosis.—Asthma is occasionally cured, and more frequently relieved; but, in the great majority of cases, after being once established, it continues with more or less frequent recurrence of the paroxysms until the close of life. When uncomplicated, it is almost never fatal, notwithstanding its apparent violence; but it is not unfrequently associated with fatal diseases; and there is reason to believe that it sometimes produces them, and is thus the remote cause of death. A judgment, therefore, as to its results, in any particular case, must be founded on the character of the attendant diseases.

Treatment.—There are two prominent indications in the treatment of asthma; one to relax the spasm, the other to correct the predisposition. The former is presented in the paroxysm, the latter in the interval.

The symptoms of the asthmatic paroxysm so strongly suggest the idea of congestion and inflammation of the lungs, that blood-letting is apt to present itself to the mind as a necessary remedy. Should the disease be associated with considerable bronchitis, and a strong excited pulse, this remedy may be employed with propriety; but, in the absence of inflammation, or of decided congestion, and when the pulse is at the same time rather feeble than strong, it should be avoided as rather injurious than beneficial. One of the most effectual means of producing relaxation is the use of *emetic substances*. These may be given so as to vomit, or merely to sustain a considerable degree of nausea. Ipecacuanha is much employed. It may be given in the full emetic dose, and afterwards, if deemed necessary, in small doses, so as to nauseate. Lobelia, too, has great reputation, and is certainly in some instances very effectual, though it fails, as every remedy is liable to do, in others. I think I have derived more advantage from it than from any other single remedy. Tartar emetic and squill have also been employed. Colchicum administered so as to produce moderate nausea, is especially applicable to gouty cases. The emetic and nauseating treatment generally is best adapted to the disease, when associated with a degree of bronchial inflammation.

Antispasmodics are often very useful in the purely spasmodic cases. Sulphuric ether, assafetida, and musk, are among the most effectual; and they are often usefully associated with one of the salts of morphia. They are especially beneficial in hysterical cases. Strong coffee is also much employed, and is often serviceable. It should be saturated, and a cup full taken every twenty or thirty minutes. As it loses its effects somewhat upon repetition, it is a good plan to abstain from its habitual use at meals.

Certain *narcotics* have been much and beneficially employed. Some caution, however, is requisite in their use. When the asthma is associated with hypertrophy of the heart, and a tendency to cerebral congestion, or when the affection has resulted from translated gout, especially in persons of an apoplectic habit, they may prove dangerous by making the brain the centre of irritation, and consequently of an afflux of blood. The death of asthmatic patients has been ascribed, in repeated instances, to the use of narcotics. Stramonium is the one which enjoys the highest reputation. It is employed almost exclusively by smoking the dried leaves or stems, like tobacco. The relief which it affords is sometimes great and immediate. It is most efficient when used at the commencement of the paroxysm. But it not unfrequently fails, and has sometimes proved highly dangerous and even fatal in its effects, by inducing coma. It should, therefore, always be used with due reference to the cautions above given, and should be omitted as soon as it produces vertigo or nausea. The smoking of tobacco also occasionally affords great relief. Chloroform, administered by means of inhalation, sometimes completely resolves the paroxysm; but care is required to prevent a too powerfully depressing effect. It would probably be safer to administer it in connexion with ether; and these same remedies may be given in combination by the stomach. Opiates are very useful in the purely spasmodic cases, without tendency to cerebral disease. The salts of morphia are perhaps preferable to the other preparations. They may often be usefully associated with the other medicines employed, as with sulphuric ether and colchicum. Hydrocyanic acid has been recommended; but, to produce a decided impression, it must be employed in quantities which may readily become hazardous.

Besides the three classes of medicines above mentioned, many other remedies have been used with greater or less advantage in the paroxysm. The application of electricity or electro-galvanism has occasionally arrested it. The same may be said of cold water, dashed in the quantity of a pail-full over the shoulders. The simultaneous use of cold drinks and hot pediluvia has been recommended. Sinapisms or other powerful rubefacients to the chest sometimes afford relief; but there is danger that some of the more volatile substances of the class may increase, by their vapours, the sense of suffocation. Insufflation of the lungs by a pair of bellows is among the means which are said to have been used with advantage. The inhalation of the fumes of burning paper, previously impregnated with a saturated solution of nitre and dried, is asserted to be sometimes very effective. It is best that the paper should have been dipped a second time into the solution and dried. It may be either burned in the chamber, or smoked by means of a pipe, or in the form of a cigar. M. Collidoni cures the disease by causing the patient to smoke sarsaparilla, by means of a pipe, in the same manner as tobacco. (*Journ. de Pharm.*, 3e sér., xviii., from *Bulletin Gén.*, Aug. 1850.) M. Rayer applies solution of ammonia, by means of a roll of lint moistened with it, to the velum pendulum palati, for a few seconds, and with almost uniform advantage. The patient is at first seized with a feeling of suffocation, which is followed by coughing and copious expectoration, and soon afterwards with great relief. (*Am. Journ. of Med. Sci.*, N. S., xiii. 165, from *Annales de Thérapeutique*.) Dr. A. M. Johnson, of Illinois, has administered sulphate of quinia in a single dose of twelve grains in the paroxysm, with success in several cases. (See *Wood's Quart. Retrosp.*, ii. 2.) Dr. J. P. Root, of New Hartford, Connecticut, has obtained extraordinary effects from sulphate of lime. (*Boston Med. and Surg. Journ.*, l. 33.) In cases attended with spinal tenderness, cups or leeches should be applied over the tender vertebræ, and followed in due time, by strong ammonia, a fly blister, or tartar emetic ointment. The apartment should be well aired, all articles of dress that in any degree restrain the movements of the chest should be removed, as few assistants as will answer the purposes of attendance should remain in the room, and smoke and other exhalations should be carefully avoided.

In the interval, our efforts should be directed to the removal of the morbid tendency; and, for this purpose, every discoverable deviation from health should be corrected as far as practicable. It is impossible to particularize all the remedies that may be employed. The attention should be directed particularly to the state of the stomach and bowels. Dyspeptic symptoms may require antacids, carminatives, and tonics; constipation, laxatives; deranged hepatic secretion, the mercurial alteratives. In the female, the menstrual function should be kept in order. In gouty cases, moderate doses of colchicum may be found beneficial. Anemia and general debility must be counteracted by tonics and a suitable regimen. Dr. T. S. Hopkins, of Bethel, Georgia, has found special advantage from nitric acid. (*Am. Journ. of Med. Sci.*, N. S., xx. 549.) If chronic bronchial inflammation exist, it should be treated with local depletion, blistering, the stimulating and nauseating expectorants, &c. Any remains of the spasm, connected with the inflammation, may be advantageously treated with tincture of lobelia, associated with ipecacuanha wine or syrup, the tincture or syrup of squill, or the syrup of seneka. In some cases, the metallic tonics which prove useful in nervous affections, as chorea, epilepsy, hysteria, and neuralgia, have the effect of interrupting or postponing the paroxysms. For this purpose may be employed, subnitrate of bismuth, oxide and sulphate of zinc, ammoniated copper, nitrate of silver, and the chalybeates, which may sometimes be conjoined with small doses of opium. Dr. Huss, of Sweden, has found the disease to yield promptly to chloride of platinum, given in the dose of half a grain, three or four times daily. When the paroxysms occur at precisely regular intervals, with complete intermission, there is some chance of interrupting them by sulphate of quinia. Strong moral or physical impressions of any kind will sometimes avert them. Dr. Lefèvre, a French physician, who published a paper on asthma, used frequently to set aside a paroxysm, in his own case, by having his bed heated, or heating himself before a fire. (*Valleix*, ii. 564.)

The diet should be easy of digestion and nutritious, yet not stimulating. Caution should be particularly observed not to overload or distend the stomach. Alcoholic drinks, as well as the habitual use of tea and coffee, should be forbidden. Advantage will sometimes accrue from the daily use of the shower-bath, or sponging the chest with cold water or salt and water; but these means should not be employed unless followed by immediate reaction. Exercise is highly useful, especially on horseback. The place of abode should be chosen in reference to the particular experience of the patient, that being preferred which is found to suit him best. As a general rule, a mild, equable climate, neither very moist nor very dry, is the most favourable. Travelling is sometimes highly advantageous. In this as in other habitual nervous affections, it is useful to surround the patient with entirely new circumstances, so that a new set of impressions may be made on his nervous system. A long voyage, or a protracted journey abroad, would offer some hope of a permanent cure, should no organic disease exist.

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